Northeast Asia Crane Wintering Sites

Field Observations and Background on Important Crane Wintering Grounds in China, South Korea, and Japan

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Cover Photo:
Red-crowned Cranes *Grus japonensis*, Akan International Crane Center, Kushiro Subprefecture, Hokkaido, Japan

Note: All location point coordinates included in this report were obtained freely online from Google Earth, https://earth.google.com/web/.

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International Crane Foundation, Baraboo, Wisconsin
Nanchang Five Star Siberian Crane Sanctuary, Jiangxi, China
Waterbird Network Korea, Seoul, South Korea
Eco-Education Hub Waterfowl Egg, Ganghwa Do, South Korea
Ganghwa Bird Watching Club, Ganghwa Do, South Korea
Suncheon Bay Wetland Reserve, Suncheon, South Korea
Seosan Birdland, Seosan, South Korea
DMZ Peace Town for Migratory Cranes, Yangji Gil Village, Cheorwon County, South Korea
DMZ Crane Committee, Yangji Gil Village, Cheorwon County, South Korea
Clean Hantan River, Yeoncheon, South Korea
Hantan River Geopark, Yeoncheon, South Korea
Izumi City Crane Museum and Park, Izumi, Kagoshima Prefecture, Japan
Izumi Crane Observatory, Izumi, Kagoshima Prefecture, Japan
Kagoshima Crane Conservancy, Izumi, Kagoshima Prefecture, Japan
Red-crowned Crane Conservancy, Kushiro City, Hokkaido, Japan
Akan International Crane Center, Kushiro Subprefecture, Hokkaido, Japan

List of Acronyms Used

CCZ	Civilian Control Zone
CNY	Chinese Yuan
CR	Critically Endangered
DMZ	Demilitarized Zone
EAAFP	East Asian-Australasian Flyway Partnership
EN	Endangered
IBA	Important Bird Area
ICF	International Crane Foundation
IUCN	International Union for Conservation of Nature
JPY	Japanese Yen
KRW	Korean Won
LC	Least Concern
NGO	Non-governmental Organization
NIBR	National Institute of Biological Resources, Incheon
PLNNR	Poyang Lake National Nature Reserve
RCC	Red-crowned Crane Conservancy
RMB	Renminbi
ROK	Republic of Korea
SBWR	Suncheonman Bay Wetland Reserve
TKG	Red-crowned Crane Conservancy (Japanese language acronym)
TMR	TMR Feed Cooperative
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFAO	United Nations Food and Agriculture Organization
USD	United States Dollar
VU	Vulnerable
WWF	World Wildlife Fund
YNA	Yonhap News Agency

1. Introduction

This report summarizes field observations made during visits to important crane wintering grounds in Northeast Asia from December 2019 to January 2020. Sites visited during this journey were, in chronological order, Poyang Lake in China; Suncheon Bay, the Ganghwado Mudflats, Yeoncheon County, and Cheorwon County in South Korea; and the Izumi, Kushiro, and Tokachi Wetlands in Japan (Figure 1.1, Table 1.1). In addition to field observations, brief summaries of literature reviews conducted for each site are also provided. These summaries include historical overviews of crane population data and conservation efforts at each site as well as current threats to cranes. Short descriptions are also included for five important winter crane sites in the Northeast Asia region that the author did not visit, namely the Yangchen and Yellow River Delta Nature Reserves in China and the Junam Reservoir, Paju, and Panmunjeom crane areas of the Korean Peninsula.

Field methods employed included a mix of fixed-point observations as well as opportunistic observations made while walking or driving as detailed in the report sections for each site. In total, seven of the world’s fifteen crane species were observed at the eight sites visited, namely Siberian, hooded, white-naped, red-crowned, common, sandhill, and demoiselle cranes, although the latter two species were quite rare (Table 1.1). The current global status of these seven species and their scientific, Chinese, Korean, and Japanese names are summarized in Tables 1.2 and 1.3 below. It is hoped that this report will provide readers with a better understanding of the global importance of these interconnected crane wintering grounds as well as the persistent threats to cranes and their winter habitat in Northeast Asia.

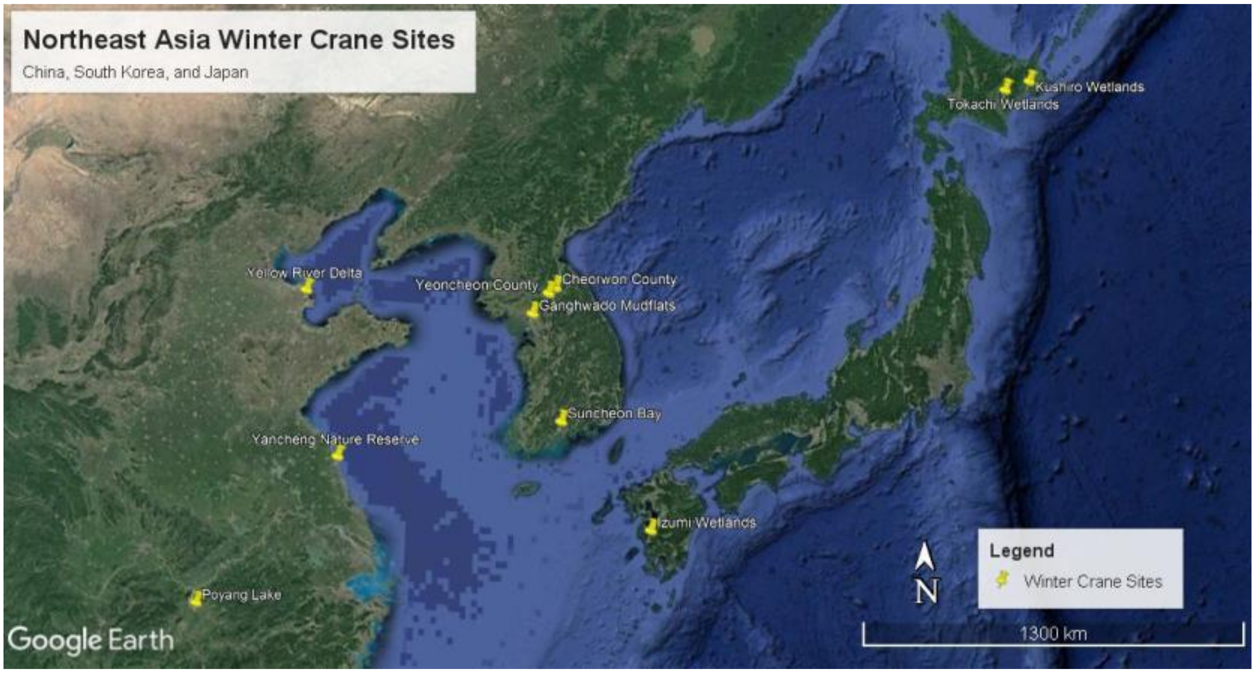


Figure 1.1. Overview map of important crane wintering grounds in Northeast Asia.

Table 1.1. List of Northeast Asia crane sites visited from December 2019 to January 2020 with recent counts of the seven crane species observed compiled from field observations by various researchers, as noted. Sites are listed north to south.

Site (North to South)	Location	Count Date	Siberian Crane	Hooded Crane	White-naped Crane	Red-crowned Crane	Common Crane	Sandhill Crane	Demoiselle Crane
Akan International Crane Center[1]	43° 08'36.38"N, 144°08'56.65"E	January 26, 2020	–	–	–	175	–	–	–
Tokachi Subprefecture[1]	42°55'52.35"N, 143°17'34.56"E	January 27-28, 2020	–	–	–	217	–	–	–
Cheorwon County[2]	38°17'9.00"N, 127°14'16.00"E	January 18, 2020	–	5	4573	1179	7	1	–
Yeoncheon County[2]	38° 7'46.67"N, 126°59'21.25"E	January 17, 2020	–	–	507	396	–	–	–
Ganghwado Mudflats[2]	37°35'49.50"N, 126°31'25.07"E	January 19, 2020	–	–	–	44	–	–	–
Suncheon Bay[3]	34°53'8.96"N, 127°30'3.49"E	December 30, 2019	–	2383	10	–	**7**	1	–
Izumi Crane Observation Center[4,5]	32° 6'9.21"N, 130°16'30.98"E	December 21, 2019 and *January 2020	–	13,501	1642 *2688	–	4	7	1
Poyang Lake[6]	29°11'13.29"N, 116° 0'35.16"E	December 18, 2018	3399	334	1141	–	4852	–	–

Source Notes: [1]Yulia Momose, personal communication, 24 June 2020; [2]National Institute of Biology (NIBR), unpublished data; [3]Suncheonman Bay Wetland Reserve: Visitor Center Sign Board; [4]Izumi Crane Observation Center: Visitor Center Sign Board; [5*]Kagoshima Crane Conservancy; [6]Liu and Liao, 2019.

Table 1.2. Current IUCN Red List status, global population estimates, and population trend for the seven species of cranes observed at Northeast Asia winter crane sites from December 2019 to January 2020.

Common Name	Scientific Name	IUCN Red List	Global Population (2019)	Trend (2019)
Siberian	*Grus leucogeranus*/ *Leucogeranus leucogeranus*	CR	3600-4000	Probably Stable
Red-crowned	*Grus japonensis*	EN	2800-3430	Increasing but Declining in China
Hooded	*Grus monacha*	VU	14,500-16,000	Increasing
White-naped	*Grus vipio*/*Antigone vipio*	VU	6700-7700	Eastern Population Increasing Western Population Decreasing
Demoiselle	*Grus virgo*/*Anthropoides virgo*	LC	170,000-220,000	Decreasing
Common	*Grus grus*	LC	>700,000	Western Population Increasing Eastern Population Decreasing
Sandhill	*Grus canadensis*/*Antigone canadensis*	LC	827,000	Increasing

Note: CR=Critically Endangered, EN=Endangered, VU=Vulnerable, LC=Least Concern
Source: Mirande and Harris, 2019; IUCN, 2020.

Table 1.3. Summary of the scientific, Chinese, Korean, and Japanese names of the seven crane species observed at Northeast Asia winter crane sites from December 2019 to January 2020.

English	**Siberian Crane**	**Hooded Crane**	**White-naped Crane**	**Red-crowned Crane**	**Common Crane**	**Sandhill Crane**	**Demoiselle Crane**
Scientific	*Grus leucogeranus*	*Grus monacha*	*Grus vipio*	*Grus japonensis*	*Grus grus*	*Grus canadensis*	*Grus virgo*
Chinese	白鶴	白头鶴	白枕鶴	丹顶鶴	灰鶴	沙丘鶴	蓑羽鶴
Japanese	ソデグロヅル	ナベヅル	マナヅル	タンチョウ	クロヅル	カナダヅル	アネハヅル
Korean	시베리아흰두루미	흑두루미	재두루미	두루미	검은목두루미	캐나다두루미	쇠재두루미

2. Poyang Lake

Jiangxi Province, China

Ramsar Listed: March 31, 1992

Dates Visited: December 20-22, 2020

2.1. Site Description and Background

Poyang Lake (鄱阳湖, 29°10'N, 116°12'E) is China's largest freshwater lake (Fig. 2.1). Located on the lower Yangtze River in China's Jiangxi Province, the lake lies about 60 km northeast of Nanchang, the Jiangxi provincial capital (Figs. 1.1 and 2.2). The lake has an elevation that fluctuates seasonally between about 12 and 18 m, a maximum length and width of approximately 125 km and 55 km, respectively, and a total area of about 3500 km^2. Poyang Lake forms part of a major shipping route that connects the interior of Jiangxi Province with Yangtze River ports and the East China Sea via the Gan River, the major river flowing into the lake (Figs. 2.2 and 2.6). In fact, the roughly 75 km wide Gan River delta is the dominant feature of the lake. The second most notable river flowing towards the lake is the Xiu River, which merges with a branch of the Gan River at Wucheng Town (Figs. 2.2 and 2.6). Particularly on the vast Gan River delta, the "lakeshore" is comprised of complex networks of dozens of distinct ponds and lakes that are seasonally flooded. These pond and lake networks form the core area of the 224 km^2 Poyang Lake National Nature Reserve (鄱阳湖国家级自然保护区), centered on Wucheng Town on the northern Gan River delta, which was designated as a Ramsar site in 1992 (Fig. 2.6)(PLNNR, 2015; Ramsar, 2020a). They also form the core area of the 333 km^2 Nanji Wetland National Nature Reserve (南矶湿地国家级自然保护区), centered on the southeastern area of the Gan delta around Nanji Town (Fig. 2.7)(Zhang et al., 2019).

Poyang Lake has a large seasonal fluctuation in water level, typically three to four meters, reaching a maximum during the summer rainy season (Jin, Wu et al., 2012; Jin, Liu et al., 2012). However, during an extreme drought from 2011-2012, the area of the lake was reduced to just 200 km^2, a situation that was believed to have been exacerbated by the filling of the then new Three Gorges Dam, which became fully operational in May 2012 (Thibault, 2012; Ives, 2016). A second factor contributing to lowered water levels at the lake has been extensive sand mining that has fed China's construction boom and resulted in widespread channel incision (Ives, 2016). Obviously, a continued long-term absence of water will severely comprise the lake basin's value as waterbird habitat. However, in July 2020, the water level of Poyang Lake reached an all-time high of 22.6 m, threatening the area with catastrophic flooding (Xinhua, 2020). This may, like severe drought, also adversely affect the shallow water tuber supply that cranes and other waterbird species depend on for food in winter (Mirande and Ilyashenko, 2019a).

The Poyang Lake Migratory Bird Reserve was established in June 1983 by the Jiangxi provincial government. In 1988, the reserve was elevated to national-level protected status by the central

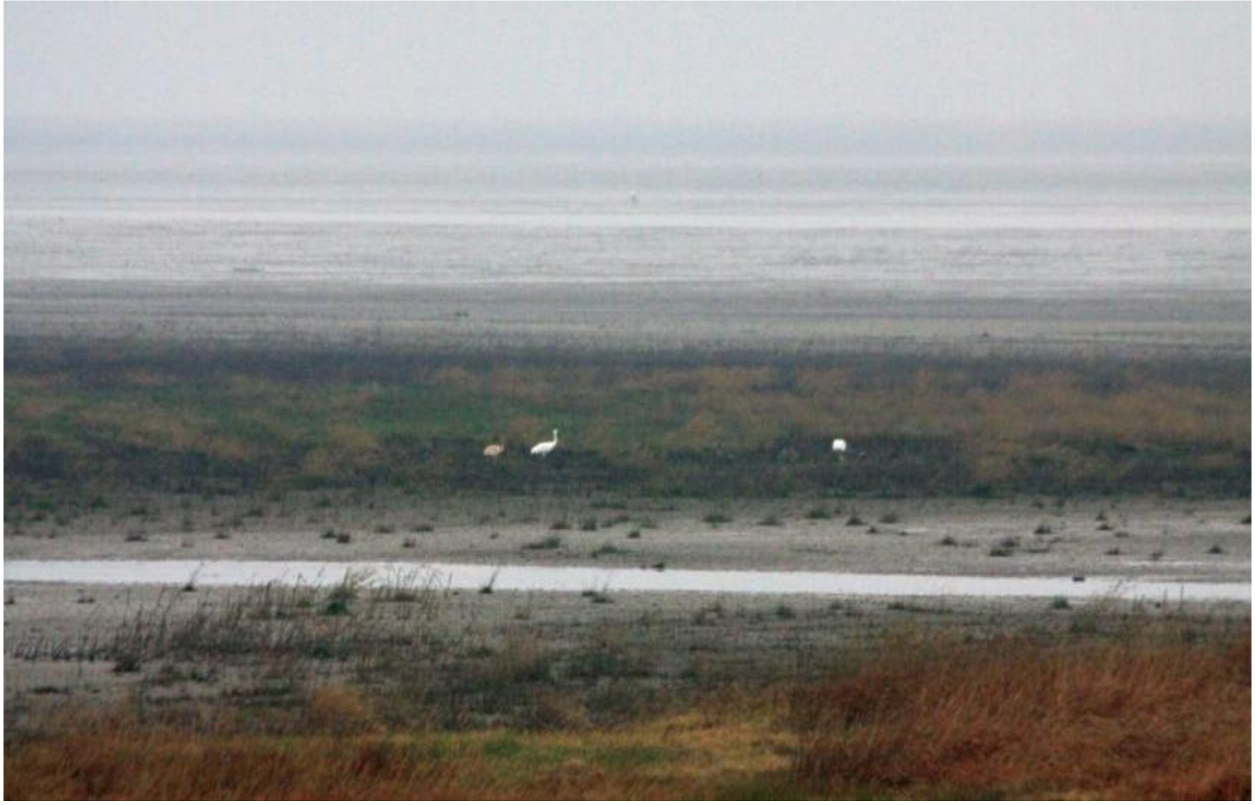


Figure 2.1. Siberian crane family, Sha Hu Xiang, Poyang Lake, Jiangxi Province, China.

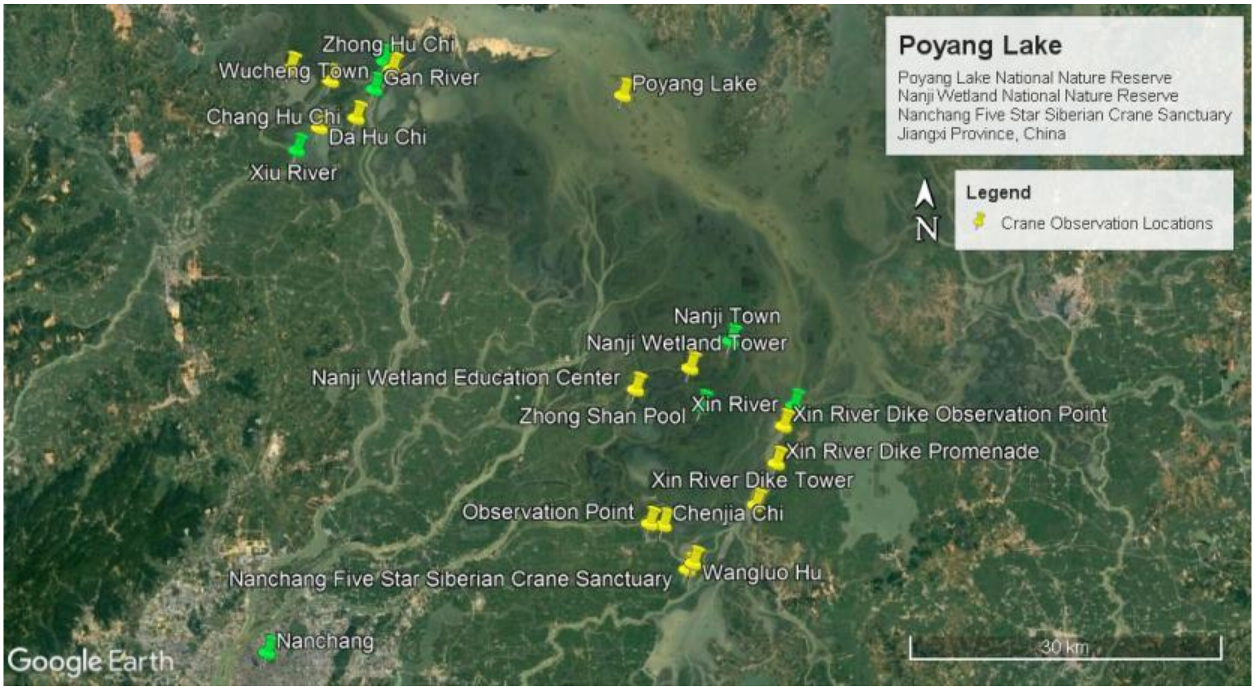


Figure 2.2. Overview of Poyang Lake crane sites, Jiangxi, China.

Table 2.1. Large waterfowl counts made at Poyang Lake on December 18, 2018.

Common Name	Scientific Name	Count
Oriental Stork	*Ciconia boyciana*	2721
Eurasian Spoonbill	*Platalea leucorodia*	20,709
Tundra Swan	*Cygnus columbianus*	40,474
Swan Goose	*Anser cygnoides*	97,452
Bean Goose	*Anser fabalis*	96,707
Greater White-fronted Goose	*Anser albifrons*	46,839

Source: Liu and Liao, 2019.

government and renamed the Poyang Lake National Nature Reserve (Liu et al., 2012). The Nanji Wetland National Nature Reserve was established in 1995 (UNFAO, 2019). However, it should be noted that the entire Gan River delta has been heavily engineered for rice and fish farming. These engineering works include a vast network of river flood dikes, pond dikes with sluice gates to facilitate raising and lowering of water levels for fish farming, and canals for both irrigating and draining rice paddies.

Poyang Lake is notable for its critically endangered Yangtze finless porpoise (*Neophocaena asiaeorientalis* ssp. *asiaeorientalis*) population, which, with the declared functional extinction of the Yangtze river dolphin or baiji (*Lipotes vexillifer)* in December 2006, became the flagship species of WWF China’s Living Yangtze Programme (Associated Press, 2006). Finless porpoise protection is now the focus of much effort with respect to regulating fishing practices and water levels at Poyang Lake and other Yangtze River floodplain wetlands. With respect to birds, 310 species had been recorded in the Poyang Lake National Nature Reserve as of 2015 while in December 2014 over half a million waterbirds were counted in a 5000 km^2 area of the lake basin (PLNNR, 2015; Zhan and Liao, 2015). One notable species among these is the endangered oriental stork (*Ciconia boyciana*). The oriental stork went extinct in Korea and Japan in the 20th Century but has persisted in wintering in large numbers at Poyang Lake, with 2721 counted in December 2018 (Table 2.1). In addition, tens of thousands of geese, swans, Eurasian spoonbills (*Platalea leucorodia*), and ducks overwinter or stopover on migration passage at Poyang Lake (Table 2.1)(also see Appendix 2).

Of greatest interest for this report is the critically endangered Siberian crane (*Grus leucogeranus*) (Fig. 2.4). At the turn of the 21st Century, there were three known Siberian crane wintering sites (Fig. 2.3). The westernmost was the Naurzum Lake System in the Caspian Region of northern Iran, where up until 2014 one or two Siberian cranes were sighted annually (Mirande and Ilyashenko, 2019a). In October 2019, the Tehran Times reported the return of the last known remaining member of the western population (Tehran Times, 2019). The central wintering site was in Rajasthan, India. However, last pair of Siberian cranes in India were sighted on their wintering grounds at the Keoladeo National Park in Rajasthan in the winter of 2001–2002 (Mirande and Ilyashenko, 2019a; Bose, 2015).

This leaves Poyang Lake as the last known wintering ground of the Siberian crane. In 1980, just prior creation of the Poyang Lake Migratory Bird Reserve, a total of 91 Siberian cranes were counted at the lake (Ji et al., 2007). However, following 40 years of improved rangewide protection, this number had grown to a remarkable 3399 in December 2018 (Table 2.2, Fig. 2.5)(Liu and Liao, 2019). Thus, at Poyang Lake, the entire Siberian crane population is concentrated in

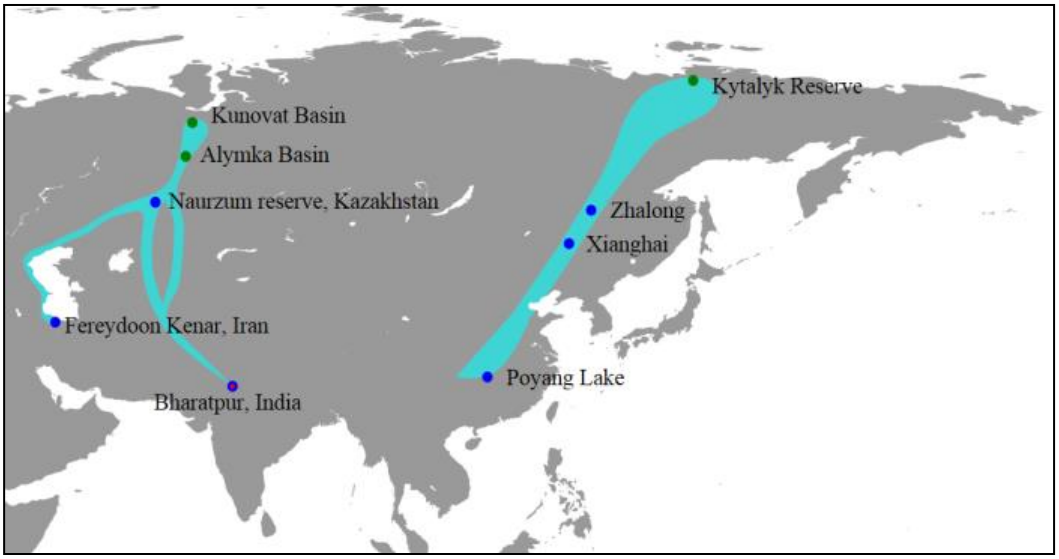


Figure 2.3. Historical Siberian crane migration route map. Only the eastern migration route remains. Source: Shyamal, 2011.

one relatively small area each winter where its primary food, submerged tubers of the genus *Vallisneria*, has been threatened by falling summer lake levels in recent years (Thibault, 2012; Ives, 2016; Mirande and Ilyashenko, 2019a). In addition to Siberian cranes, significant numbers of common, white-naped, and hooded cranes also overwinter at Poyang Lake (Table 1.1).

2.2. Field Methods

A three-day visit was made to Poyang Lake from December 20-22, 2020. Methods used for the survey at Poyang Lake were primarily fixed-point counts performed with a spotting scope and supplemented with binocular counts. Some short walking transects were also conducted during which cranes were sighted opportunistically. In addition, occasional opportunistic sightings were made while driving between fixed point locations.

2.3. Results

2.3.1. Poyang Lake: Day 1 – December 20, 2019

We departed from Nanchang at about 8:00 AM on a cold (7°C) rainy Friday morning. After leaving the main highway, we drove along the muddy road atop a county dike system to arrive at the village of Sha Hu Xiang at 10:15 AM, where two weeks earlier events were held for the first Poyang Lake International Birdwatching Week (Table 2.3, Figs. 2.1, 2.2, and 2.6)(Xinhua, 2019a). A new lake front promenade and picnic shelter were built at Sha Hu Xiang in time for the bird festival which provide clear but distant views of birds along the lake shore and wading in the shallows. At the time of our visit, there were at least seven Siberian crane pairs, each with a lone juvenile, seven white-naped cranes (*Grus vipio*), and four common cranes (Table 2.6). Other notable species present included 115 oriental storks, hundreds of greater white-fronted

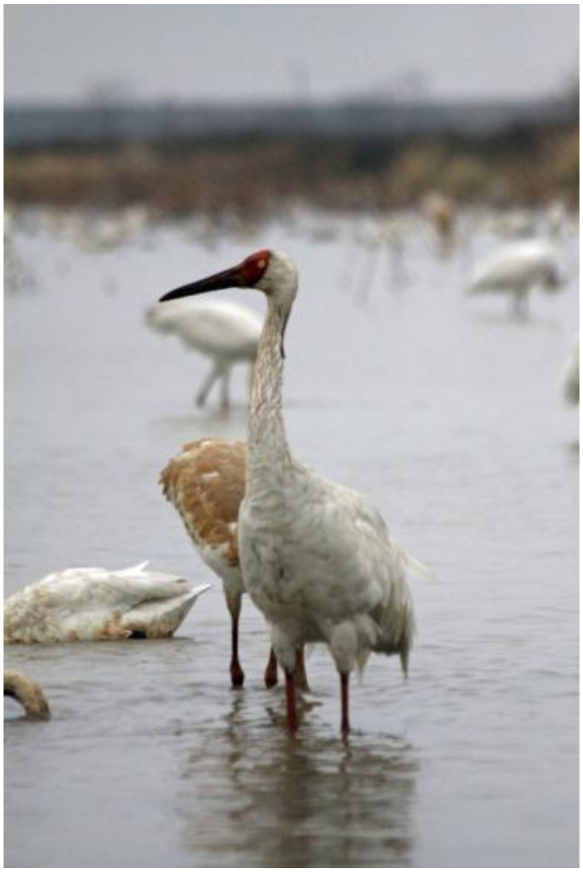


Figure 2.4. Siberian crane *Grus leucogeranus* photographed at the Nanchang Five Star Siberian Crane Sanctuary, Jiangxi Province, China.

Table 2.2. Counts of Siberian cranes at Poyang Lake, 1980 to 2018.

Year	Siberian Cranes	Source and Notes
1980	91	Source: Ji et al., 2007 (1980-2005 only)
1981	148	
1982	189	
1983	730	Year the first reserve was established
1984	840	
1985	1482?	
1986	?	
1987	1882	
1988	2653	
1989	1929	
1990	1545	
1991	2000	
1992	2709	
1993	2958	
1994	~2840	
1995	2639	
1996	2345	
1997	1917	
1998	2526	
1999	2536	
2000	1791	
2001	3100	
2002	2841	
2003	3160	
2004	3119	
2005	2999	
2014.12	3872	Zhan and Liao, 2015
2015.01	3828	Liao, Liu, and Zhan, 2015
2018.12	3399	Liu and Liao, 2019

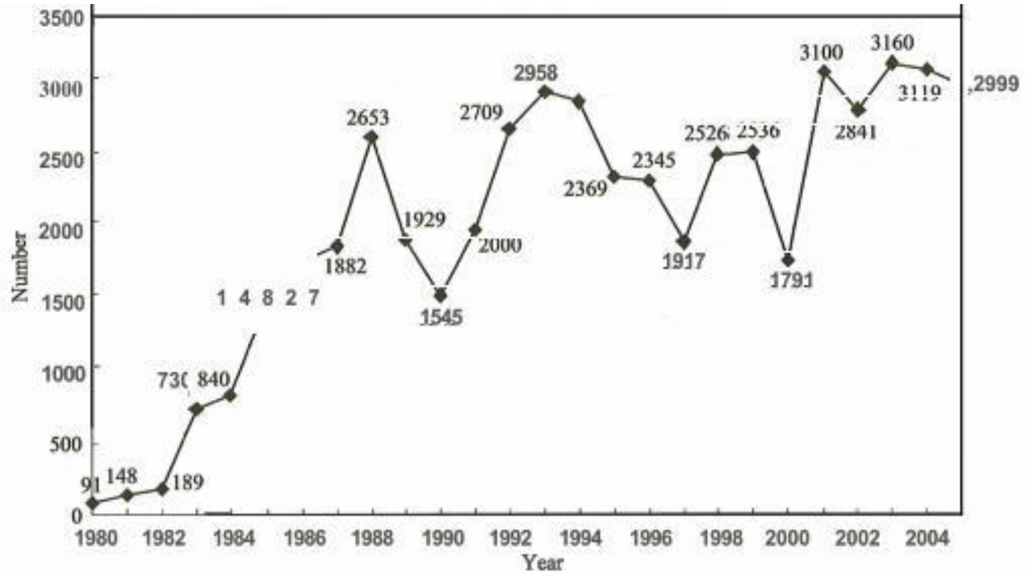


Figure 2.5. Siberian crane winter high counts at Poyang Lake, Jiangxi, China, 1980-2005. Source: Ji et al., 2007.

Table 2.3. Sites visited at Poyang Lake, Jiangxi Province, China on December 20, 2019.

Observation Location	Location (Chinese)	Latitude	Longitude	Notes
Sha Hu Xiang Observation Point	沙湖乡	29°10'47.98"N	115°54'58.91"E	Crane Festival Location
Da Hu Chi Observation Point	大湖池	29° 7'46.31"N	115°56'45.87"E	Pond location only
Chang Hu Chi Towers and Boardwalk	常湖池	29° 8'17.38"N	115°58'55.83"E	New Observation Towers and Boardwalk
Zhushi Hu	朱市湖	29°10'11.91"N	115°57'24.05"E	Road Closed to Vehicles
Wucheng Town	吴城镇	29°11'13.29"N	116° 0'35.16"E	Confluence of the Gan and Xiu Rivers

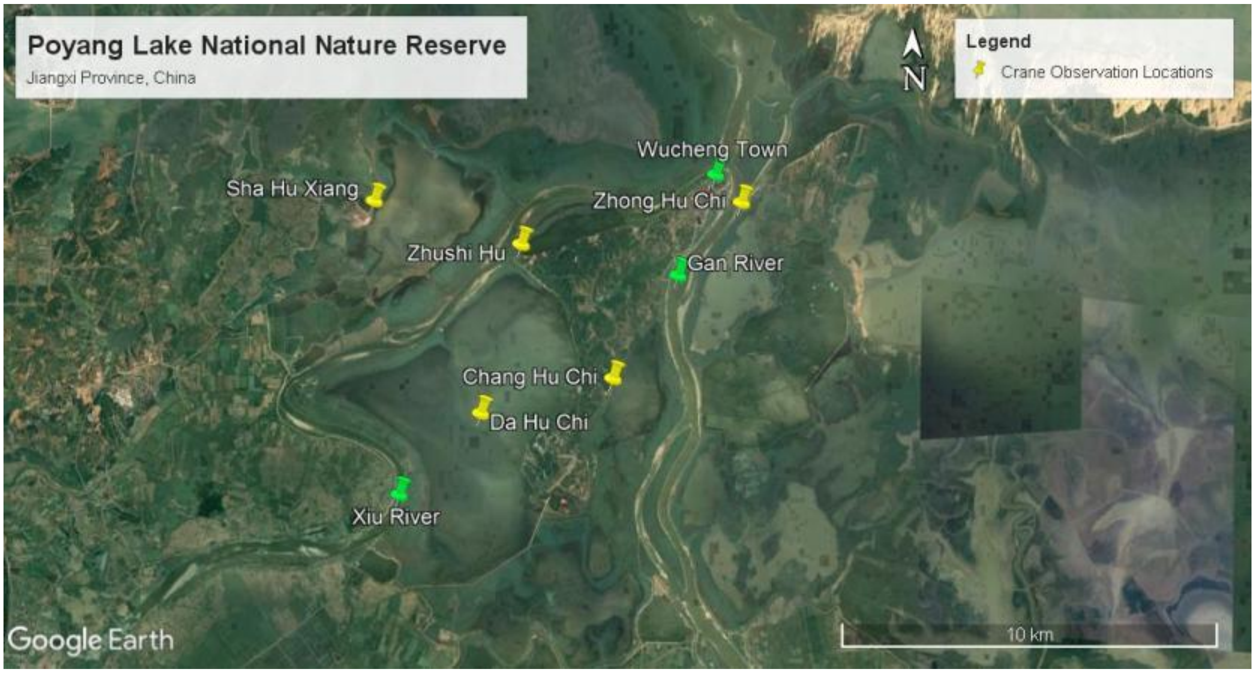


Figure 2.6. Crane observation sites visited in the Poyang Lake National Nature Reserve, December 20-21, 2019.

geese (*Anser albifrons*), about 300 Eurasian spoonbills, hundreds of pied avocets (*Recurvirostra avosetta*), and hundreds of great cormorants (*Phalacrocorax carbo*)(also see Appendix 2 for a complete list of birds sighted at Poyang Lake during this visit). It should be noted, however, that the counts made with the spotting scope were consistently far higher than the counts I made with 10x binoculars alone. Counts at Sha Hu Xiang were completed about noon.

After lunch and a quick five-minute stop on the side of Dahu Chi Pond at 1:55 PM, where we observed two hooded cranes (*Grus monacha*), we continued on to our third stop of the day at Changhu Chi Pond, arriving at 2:15 PM (Table 2.3, Fig. 2.6). A freshly paved side road through a patch of forest led to the lake and new tourist facilities completed in time for birdwatching week, which included a parking lot, rest rooms, two viewing towers, and a wetland boardwalk along a small pond. Again, views of birds were distant, with birds generally being about 100 m away at the closest. Notable sightings at Changhu Chi included a family of three Siberian cranes, four white-naped cranes, two hooded cranes, about 110 oriental storks, and 30 Eurasian spoonbills (Table 2.6). The fourth stop of the day was at Zhushi Hu at 3:25 PM, where we walked perhaps a half kilometer along a dirt road to get a view of this side pond (Fig. 2.6). No cranes were

Table 2.4. Sites visited at Poyang Lake, Jiangxi Province, China on December 21, 2019.

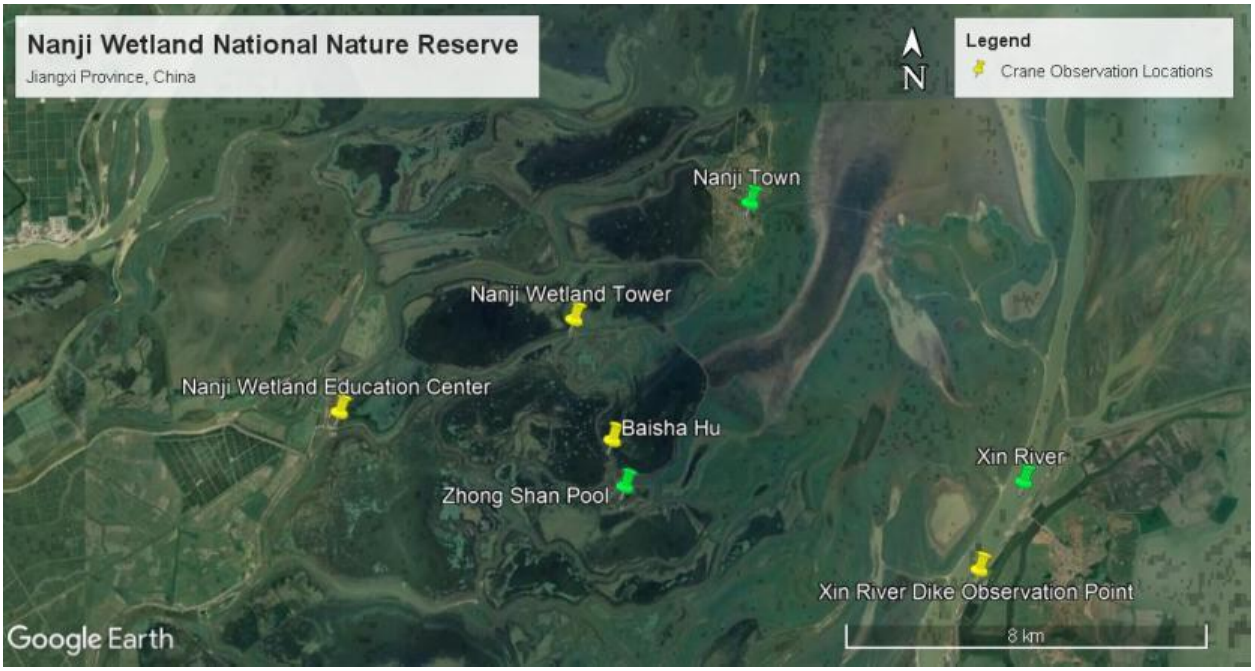
Observation Location	Location (Chinese)	Latitude	Longitude	Notes
Zhong Hu Chi Survey Route	中湖池	29°10'49.71"N	116° 1'0.84"E	Via Gan River ferry from Wucheng
Nanji Wetland National Nature Reserve Education Center	江西鄱阳湖南矶湿地国家级自然保护区自然教育中心	28°54'24.21"N	116°15'35.29"E	WWF Sponsorship
New Roadside Concrete Viewing Platform		?	?	Roadside Concrete Viewing Platform with Roof Shelter
Baisha Hu Observation Point	白沙湖	28°54'5.54"N	116°19'18.81"E	
Zhong Shan Pool	钟山潭	28°53'32.41"N	116°19'29.30"E	Village Walk – Ji Shan Village
Nanji Wetland Bird Watching Tower	瞭望塔	28°55'31.84"N	116°18'46.86"E	
Nanji Town	南矶乡	28°56'56.23"N	116°21'10.23"E	On the Xin River Delta

present, but there were about 250 bean geese (*Anser fabalis*), another 250 greater white-fronted geese, 30 Eurasian spoonbills, and one oriental stork, with more greater white-fronted geese further along the dirt road on the shores of Da Hu Chi. We spent the evening in Wucheng Town, where there is a beautiful tree-lined main street that was recently given an architectural facelift for the international birdwatching week festivities.

2.3.2. Poyang Lake: Day 2 – December 21, 2019

We started the day at 9:00 AM by taking a car ferry from Wucheng Town across the Gan River (RMB 5 for pedestrians) amidst heavy shipping traffic, presumably en route to and from the Yangtze River ports and Nanchang. Although overcast, there was no rain as we set out with the temperature about 7°C. After disembarking, we walked south for a very muddy two kilometers or so along the Gan River dike for views of Zhong Hu Chi to the east, which is used to raise fish and drained through sluice gates when the fish are harvested (Fig. 2.6). Cranes sighted at Zhong Hu Chi were one family of three Siberian cranes, 13 hooded cranes, 16 common cranes (*Grus grus*), and about 65 white-naped cranes (Table 2.6). Other waterfowl sighted included 300 bean geese, 150 greater white-fronted geese, six common pheasants (*Phasianus colchicus*), and a lone common moorhen (*Gallinula chloropus*). We took the ferry back across the river to Wucheng at 11:30 AM.

After some mid-day rain, the second stop of the day was at the Nanji Wetland National Nature Reserve Education Center at 2:30 PM, where there were about 40 tundra swans (*Cygnus columbianus*) and more greater white-fronted geese but no cranes (Table 2.4, Fig. 2.7). The day's third stop was at 2:50 PM at a new roadside concrete viewing platform between the education center and the Nanji Wetland observation tower, where we observed 120 Siberian cranes, 20 oriental storks, about 80 bean geese, and a few Eurasian spoonbills (Fig. 2.7). Next, we made a quick stop at 3:10 PM at Bai Sha Hu on a causeway side road between large ponds where we observed 12 Siberian cranes, an oriental stork, and more bean geese (Fig. 2.7). We continued along this side road to its end at Ji Shan Village, which is a rustic old brick and tiled-roof farming village with an ancient temple, a picturesque quarry pond – the Zhong Shan Pool, and forest, but no cranes on the day of our visit (Fig. 2.7). Afterwards, we backtracked past Baisha Hu to the main county road to Nanji Town, where at 4:10 PM we made our final stop of the day at the Nanji Wetland Bird Watching Tower overlooking Zhanbei Hu and Chang Hu. Here, in the fading light of day, we observed 16 oriental storks, more bean geese, and some grey herons (*Ardea cinerea*), but no cranes. We spent the night in Nanji Town.


Nanji Wetland National Nature Reserve
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N
Legend
Crane Observation Locations
Nanji Town
Nanji Wetland Tower
Nanji Wetland Education Center
Baisha Hu
Zhong Shan Pool
Xin River
Xin River Dike Observation Point
Google Earth
8 km

Figure 2.7. Crane observation sites visited in the Nanji Wetland National Nature Reserve, December 21, 2019.

2.3.3. Poyang Lake: Day 3 – December 22, 2019 – Winter Solstice

We began our third day at Poyang Lake by making a long, slow drive south through the muddy rice stubble and ponds from Nanji Town to Chenjia Chi Pond (Table 2.5, Fig. 2.8). Morning observations began at 9:50 AM along the road which runs along the top of a dike next to Chenjia Chi Pond (Fig. 2.8). At the first observation point we made a quick stop to find 18 Siberian cranes in flight and 40 little egrets (*Egretta garzetta*) (Table 2.6). We arrived at the Chenjia Chi observation point at 9:55 AM, and across the muddy rice stubble fields observed nine Siberian crane, 95 tundra swans, 75 swan geese (*Anser cygnoides*), 29 grey herons, 28 Eurasian spoonbills, four oriental storks, and many bean and greater white-fronted geese. After driving along the dike another five kilometers or so, we stopped at the southern tip of Wangluo Hu Lake at 10:40 AM for more observation (Fig. 2.8). No cranes were present, but there were so many tundra swans, swan geese, and greater white-fronted geese that I was unable to count them accurately with just binoculars.

Our fourth stop of the morning was about a half kilometer away at the Nanchang Five Star (Wuxing) Siberian Crane Sanctuary at 11:40 AM (Figs. 2.4 and 2.8). During the winter of 2012, at the height of the drought that left Poyang Lake nearly completely dry, 200 Siberian cranes sought refuge in the Wuxing Village lotus root pond that now forms the reserve, much to the annoyance of the local farmers whose lotus roots the cranes were subsisting on. Large numbers of Siberian cranes returned every year afterward, and by 2016, the affected farmers planned to convert their lotus pond into a rice paddy to put an end to the crane conflict problem. In 2017, the Nanchang Wildlife Conservation Association rented the farmers' pond, which is about 750 m long and 200 m wide, and turned it into an NGO-managed crane sanctuary for the benefit of critically endangered Siberian cranes. Since its establishment, Siberian crane numbers at the Five Star Sanctuary at one point reached a peak of 1426, nearly half the entire global population.

Table 2.5. Sites visited at Poyang Lake, Jiangxi Province, China on December 22, 2019.

Observation Location	**Location (Chinese)**	**Latitude**	**Longitude**	**Notes**
Roadside Observation Point	程家池	28°47'29.02"N	116°16'28.10"E	9:50 AM
Chenjia Chi Observation Point	程家池	28°47'24.99"N	116°17'16.68"E	9:55 AM
Wangluo Hu Observation Point	王罗湖	28°45'27.92"N	116°19'3.59"E	10:40 AM
Nanchang Five Star (Wuxing) Siberian Crane Sanctuary	南昌五星白鹤保护小区	28°45'21.54"N	116°18'43.90"E	11:40 AM
Xin River Dike Dadi Observation Tower, Kangshan Township	康山乡, 信江/大信河	28°48'29.05"N	116°22'42.76"E	
Xin River Dike Fishing Promenade Kangshan Township	康山乡, 信江/大信河	28°50'38.91"N	116°23'55.07"E	Finless Porpoise viewpoint
Xin River Dike Observation Point Kangshan Township	康山乡, 信江/大信河	28°52'34.46"N	116°24'19.76"E	Open-sided bus stop shelter with blue, leaf-shaped roof

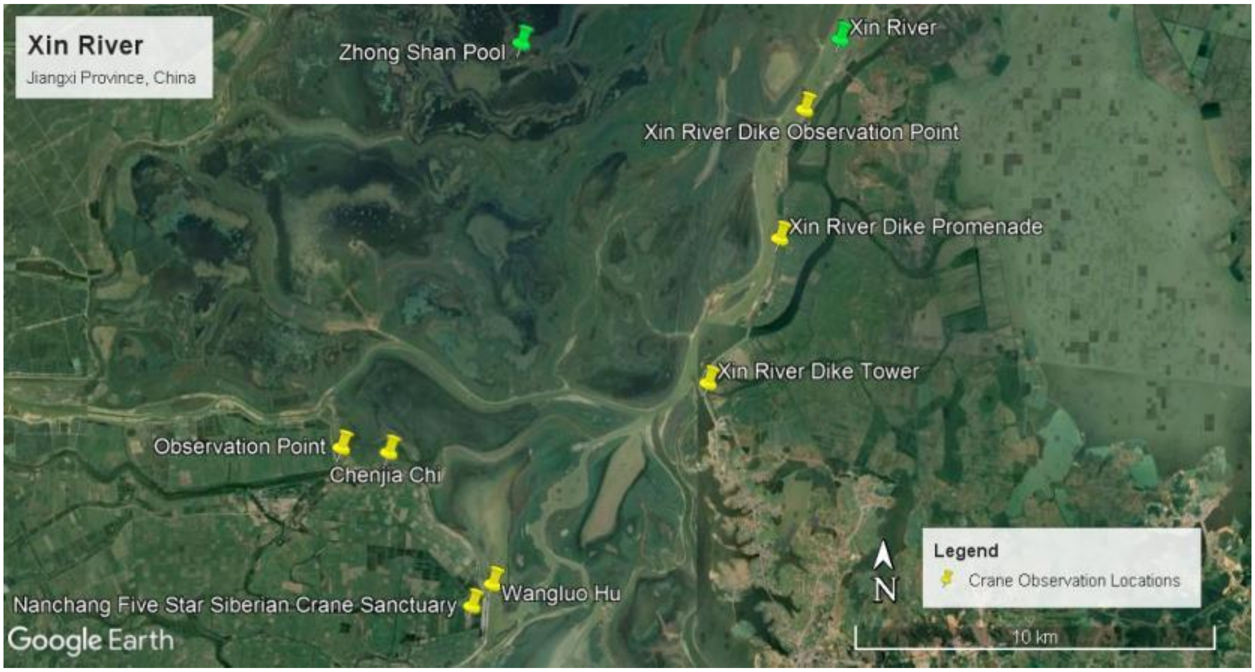


Figure 2.8. Crane observation sites visited along the Xin River, December 21, 2019.

At the sanctuary, we made observations from the very busy photographers' hide at the north end of the pond, which affords the best closeup views of Siberian cranes in the Poyang Lake area. On this particular day, the spotting scope count placed the number of Siberian cranes in the sanctuary pond at 603. Based on the December 2018 survey total of 3399 Siberian cranes at Poyang Lake, these cranes represented about 18 percent of the total global population of this species in one pond on the day of our visit (Table 1.1). Also present were hundreds of tundra swans, swan geese, three common moorhens, and a lone greylag goose (*Anser anser*).

We departed the Five Star Sanctuary at 1:55 PM, taking a circuitous route southward, across the Xin River, and down a network of narrow village lanes to County Road 692 atop the Xin River's east bank dike in Kang Shan Township. We made our next stop at 3:30 PM at the Xin River Dike

Table 2.6. Summary of crane counts by observation site at Poyang Lake, December 20-22, 2019, binocular counts only. Spotting scope counts may be significantly higher.

Observation Location and Date	**Siberian Crane**	**Common Crane**	**White-naped Crane**	**Hooded Crane**	**Oriental Stork**
Friday, December 20, 2019					
Sha Hu Xiang Observation Point	21	4	7	─	115
Dahu Chi Observation Point	─	─	─	2	─
Chang Hu Chi Tower and Boardwalk	3	─	4	2	110
Zhushi Hu	─	─	─	─	1
Saturday December 21, 2019					
Zhong Hu Chi Survey Route	3	16	65	13	─
Nanji Wetland Nat'l Nat. Res. Education Center	─	─	─	─	─
New Roadside Concrete Viewing Platform	120	─	─	─	20
Baisha Hu Observation Point	12	─	─	─	1
Zhong Shan Pool	─	─	─	─	─
Nanji Wetland Bird Watching Tower	─	─	─	─	16
Sunday, December 22, 2019					
Roadside Observation Point	18	─	─	─	─
Chenjia Chi Observation Point	9	─	─	─	4
Wangluo Hu Observation Point	─	─	─	─	─
Nanchang Five Star (Wuxing) Siberian Crane Sanctuary	603	─	─	─	─
Xin River Dike Tower, Kang Shan Township	2	265	─	─	190
Xin River Dike Fishing Promenade, Kang Shan Township	53	31	22	─	─
Xin River Dike Observation Point, Kang Shan Township	3	150	─	─	─
Total	**829**	**466**	**98**	**17**	**457**

Dadi Observation Tower, where we climbed up several stories to look for birds (Table 2.5, Fig. 2.8). The binocular count totaled two Siberian cranes, 265 common cranes, and 190 oriental storks. After a slow 15-minute roughly five kilometer drive down the dike, we arrived at a short concrete promenade on the bank of the Xin River that appeared to be a popular fishing spot (Fig. 2.8). We scanned both Sanzhou Hu Lake across the river as well as the muddy rice stubble on our side of the river, seeing 53 Siberian cranes, 31 common cranes, 22 white-naped cranes and 30 or so greater white-fronted geese. Surprisingly, while we were there, two finless porpoises appeared in the river and swam slowly past the promenade area. We continued driving down the dike a short way to where there was a pullout with a blue plastic-roofed bus stop-type shelter just across from Kang Shan Village. Here, we made our final stop of the day at 4:50 PM with daylight rapidly fading (Fig. 2.8). At this dike observation point we saw three Siberian cranes, two white-naped cranes, and 150 common cranes before departing at 5:15 PM to return to Nanchang City.

2.4. Discussion

In spite of intensive agricultural and the recent problems with falling water levels at Poyang Lake, the number of Siberian cranes wintering there has steadily increased from an estimated 2900–3000 birds in 1996 to about 4000 today (Archibald and Meine, 2019). Interestingly, in December 2019, nine Siberian cranes were even spotted in Guangdong Province for the first time at Xinhui District in Jiangmen City (22°27'25.85"N, 113°1'57.55"E), some 800 km to the south of Poyang Lake (Xinhua, 2019b). However, it is too early to speculate if this is an indication of winter range expansion for these cranes. While most waterbird species populations have increased at Poyang Lake since the 1990s, some species with notable declines include white-naped cranes and various duck species (Wang et al., 2017). White-naped crane numbers at Poyang Lake in winter have dropped from about 3000 in 1996 to about 1000 today (Mirande and Harris, 2019; Liu and Liao, 2019).

The Jiangxi provincial government is currently promoting waterfowl conservation and ecotourism at Poyang Lake and hunting of cranes and other waterfowl does not appear to be a major threat at this time. However, climate change, drought, and overgrazing-related degradation at the breeding grounds of the western white-naped crane population in Mongolia, Siberia, and northeast China may be a major cause of this species' decline at Poyang Lake. At the same time, hunting and poisoning along its migration routes may also be a continuing problem (Archibald and Meine, 2019; Mirande et al., 2019; MaMing, 2012). However, one persistent threat at Poyang Lake is simply disturbance to Siberian and white-naped cranes by tourists and photographers attempting to get close up photos, which is difficult at best when approaching cranes across wide open lake shore areas (Fig. 2.1)(Picon, 2019). This will require better enforcement of bird protection rules, public education, and visitor management at the Poyang Lake nature reserves.

Another large threat is simply the congregation of virtually the entire global Siberian crane population at Poyang Lake in winter, putting this species at extremely high risk of being wiped out in an avian epidemic, by catastrophic drought, possible man-made disasters at the lake, etc. This is particularly true at the Five Star Sanctuary, where in recent years on the order of 20 to 50 percent of the entire Siberian crane population could be found in a single pond just 750 m in length. Here, these birds clearly have a great appreciation for the apparently large supply of cultivated lotus root in the pond. Finally, in recent years, there has been much discussion of constructing a dam on the river flowing out of Poyang Lake. This dam will stabilize water levels for shipping across the lake during winter dry season but will also disrupt ecosystems at the lake that depend on seasonal high and low water flows (Ives, 2016). This could have potentially devastating consequences for the aquatic plants and ecosystems that cranes and waterfowl depend on for food at the lake.

3. Suncheon Bay

South Jeolla Province, South Korea

Ramsar Listed: January 20, 2006

Dates Visited: January 2-3, 2020

3.1. Site Description and Background

The Suncheonman Bay Wetland Reserve (순천만습지, 34°53'8.22"N, 127°30'34.74"E) is located seven kilometers south of Suncheon City in South Jeolla Province, South Korea and is funded by the Suncheon City government (Figs. 1.1, 3.1, 3.2, and 3.3). The reserve lies on the estuary of the Dongcheon River and forms a bay of the Cheju-Korea Straits. It is South Korea's third largest Ramsar site and part of the nation's vast tidal mudflat complex (Ramsar, 2021). Originally named the Suncheonman Bay Natural Eco Park, the reserve was established in 2003 with an area of 28.0 km^2. In 2006, the bay was designated as South Korea's first coastal Ramsar site with an area of 35.5 km^2 (Fig. 3.4)(Ramsar, 2020b). In 2015, the natural eco park was redesignated as a wetland reserve (SBWR, 2018).

The reserve features extensive tidal mudflats that are ecologically important as winter habitat for tens of thousands of migratory waterbirds. It serves as an important winter roosting site for about 2400 hooded cranes, by far South Korea's single largest hooded crane population and the second largest winter crane population on the Korean Peninsula after Cheorwon County (Table 3.1). Many areas of the mudflats were formerly farmlands reclaimed from the sea that are being allowed to revert to tidal lands, which appear as circular plots south of the reserve sea dike (Fig. 3.1). The second major feature of the reserve are the rice paddies north of the reserve sea dike that are cultivated in an ecologically friendly manner. The stubble fields of these paddies are the primary winter feeding areas for the local hooded crane population as well as for the bay's large winter population of wild geese and ducks. As at Poyang Lake, Izumi, Cheorwon, and elsewhere, the Suncheon Bay rice paddies are a highly artificial human agricultural landscape crisscrossed with concrete irrigation channels (Fig. 3.3). A third feature of the reserve are extensively restored reed beds along the Dongcheon River riparian corridor which are crossed by a boardwalk leading to the fourth major feature, pine covered Yongsan Mountain. Yongsan Mountain rises 95 meters above Suncheon Bay and has an observatory with sweeping views of the reserve and bay (Fig. 3.1 and 3.3). On either side of the mouth of the Suncheon Bay are further rows of mountains that rise to a high point of about 230 m (Fig. 3.2).

As of 2017, 237 species of birds had been recorded at the Suncheon Bay reserve (SBWR, 2018). In addition to hooded cranes, very small numbers of white-naped, common, and sandhill cranes (*Grus Canadensis*) winter at the reserve, as do thousands of Baikal teal (*Anas Formosa*), mallards (*Anas platyrhynchos*), eastern spot-billed ducks (*Anas poecilorhyncha*), greater white-fronted geese, and bean geese as well as 40 to 50 Eurasian spoonbills (Table 3.1). Suncheon Bay

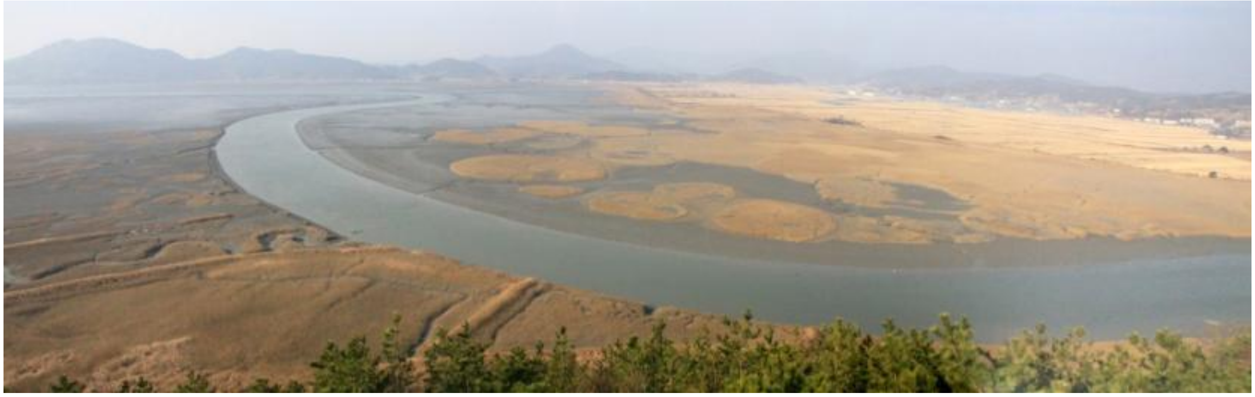
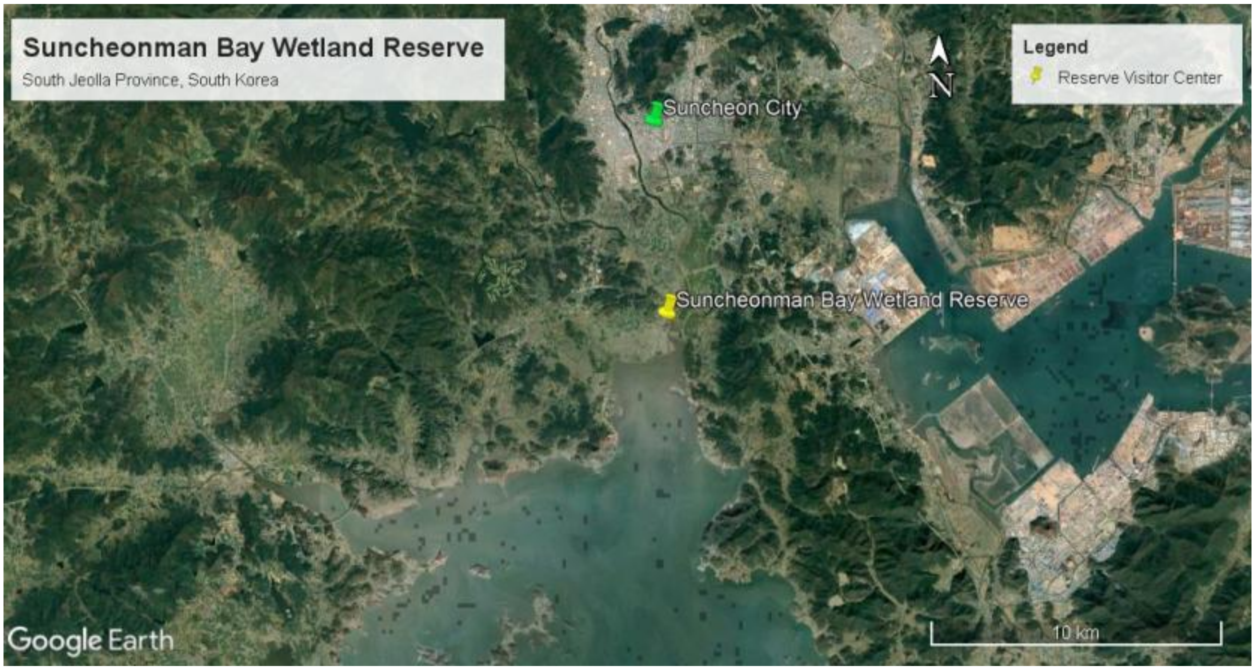


Fig. 3.1. Suncheon Bay from the Yongsan Mountain trail lookout point.



Suncheonman Bay Wetland Reserve
South Jeolla Province, South Korea
Legend
Reserve Visitor Center
N
Suncheon City
Suncheonman Bay Wetland Reserve
Google Earth
10 km

Figure 3.2. Overview of Suncheon Bay and the Suncheonman Bay Wetland Reserve, South Jeolla Province, South Korea.

Table 3.1. Crane and Waterfowl counts at Suncheonman Bay Wetland Reserve, December 30, 2019.

Crane Species	**Count**	**Waterfowl Species**	**Count**
Hooded Crane	2383	Baikal Teal	13,000
White-naped Crane	10	Mallard	12,000
Common Crane	7	Eastern Spot-billed Duck	3500
Sandhill Crane	1	Greater White-fronted Goose	1600
Red-crowned Crane	–	Bean Goose	1250
Siberian Crane	–	Eurasian Spoonbill	42
Demoiselle Crane	–	Whooper Swan	13

Source: Suncheonman Bay Wetland Reserve visitor center sign board, counts by Kang Naru.

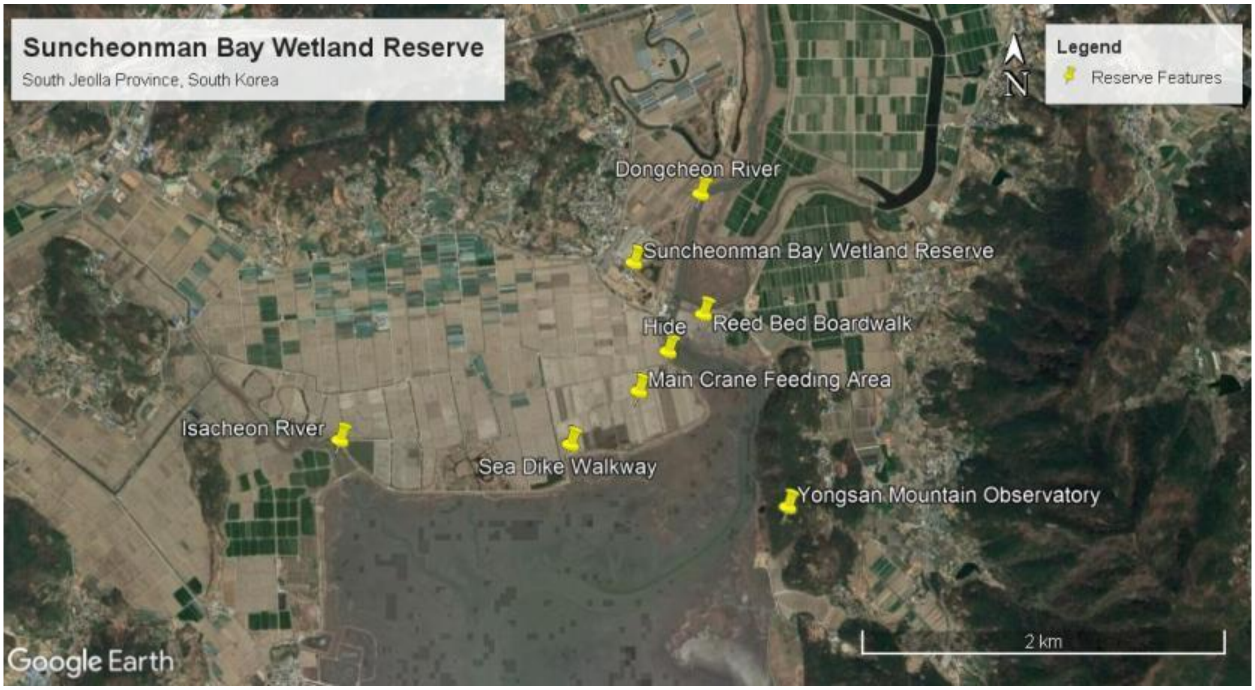


Figure 3.3. Features of the Suncheonman Bay Wetland Reserve, South Jeolla Province, South Korea.

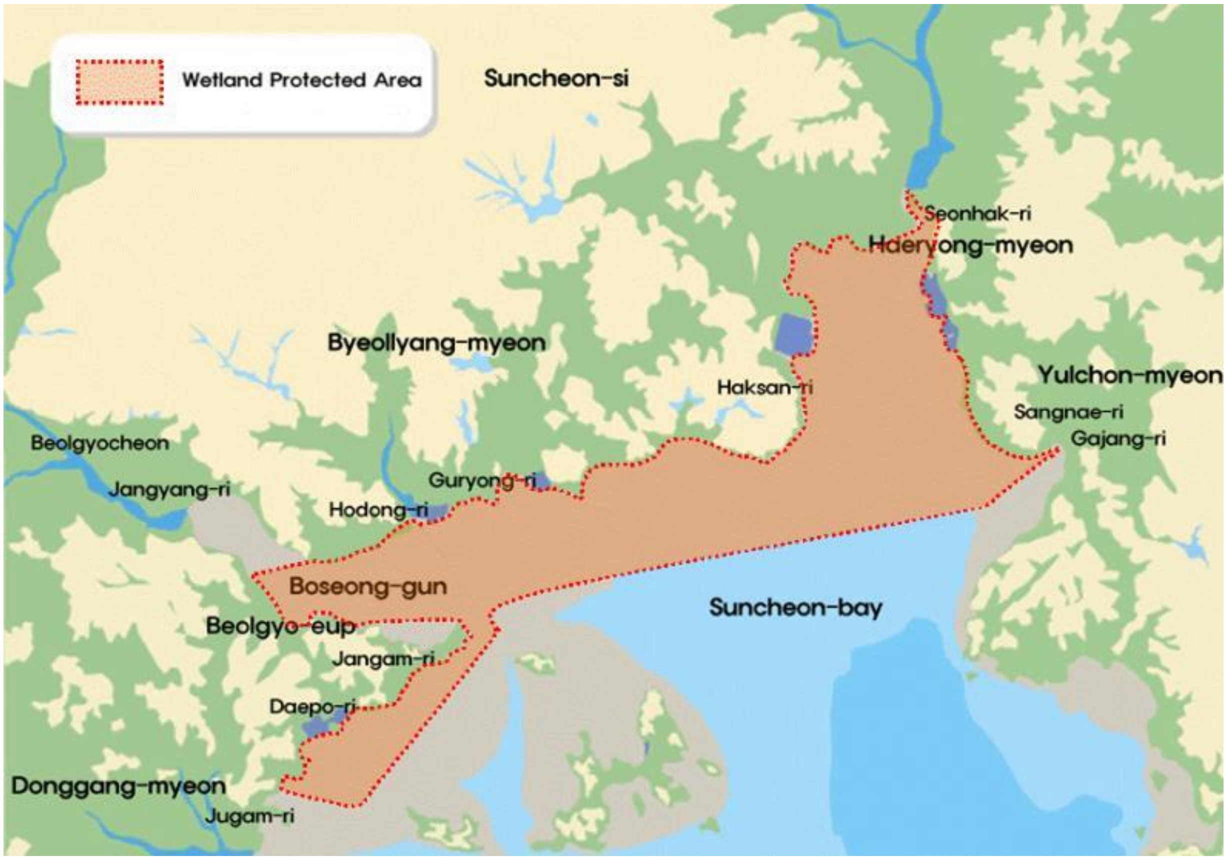


Figure 3.4. Overview of Suncheon Bay Ramsar Site and the Suncheonman Bay Wetland Reserve, South Jeolla Province, South Korea. Source: Ramsar, 2020b.

Table 3.2. Total crane counts, all species, at Suncheon Bay, 1996-2019.

Year	Total Crane Count
1996[1]	70
2004[1]	202
2009[1]	350
2012[1]*	693
2013[1]	871
2020.01.18[2]	2521

Source: [1]SBWR, 2018; [2]NIBR, unpublished data.
Note: *Year protection and habitat were improved at Suncheon Bay.

Table 3.3. Peak hooded crane counts at the Suncheonman Bay Wetland Reserve in January during winter residency and in March on northward migration from Izumi, Japan, 2013-2020.

Date	Peak January Hooded Crane Count	Date	Peak March Hooded Crane Count
2013.01.14	660	2013.03.01	515
2014.01.29	806	2014.03.17	716
2015.01.14	965	2015.03.17	841
2016.01.26	1411	2016.03.05	1231
2017.01.11	1725	2017.03.25	2200
2018.01.14	2013	2018.03.05	2864
2019.01.29	2190	2019.03.09	3300
2020.01.18	2513*	2020.03.13	4775

Source: Kang Naru, personal communication, 10 June 2020; *NIBR, unpublished data.

is a migration stopover site for small numbers of endangered black-faced spoonbills (*Platalea minor*, EN) while four oriental storks (EN) visited the reserve in 2017 (SBWR, 2018). Oriental storks went extinct in South Korea in the early 1970s due to pesticide use in rice paddies and hunting, with the male of the last known breeding pair on the Korean Peninsula having been shot in 1971 (Park et al., 2017). An intensive effort to re-establish a population of these storks on the southern Korean Peninsula, notably at the Oriental White Stork Park in Yesan, is having some early success. Another highly visible bird species at the reserve is the cinereous vulture (*Aegypius monachus*, NT), while mammal species occupying the reserve include water deer (*Hydropotes inermis*), leopard cat (*Felis bengalensis manchurica*), and Eurasian otter (*Lutra lutra*) (SBWR, 2018; Kang Naru, personal communication, 2 January 2020).

Conservation efforts did not begin at Suncheon Bay until the early 1990s and the first formal crane survey was not conducted there until 1996, at which time there were only a total of 70 cranes (Table 3.2). The annual crane count at Suncheon grew steadily with improved protection of the bay and by 2009 had reached a total of 350. However, the most rapid growth in crane numbers occurred after the mudflats in the Suncheon Bay Reserve underwent significant ecological restoration in 2012, which in combination with improved protection and artificial feeding at the reserve resulted in a near quadrupling of crane numbers from 693 in 2012 to 2521 in January 2020 (Table 3.2). This represents a 36-fold increase in crane numbers since the outset of estuary protection efforts (Tables 3.2 and 3.3, Figs. 3.5 and 3.6). The only crane species occurring in globally significant numbers at Suncheon is the vulnerable hooded crane, which migrates from its breeding grounds in the Russian Far East and Northeast China. These cranes migrate south along the Korean Peninsula to their primary wintering ground in Izumi on

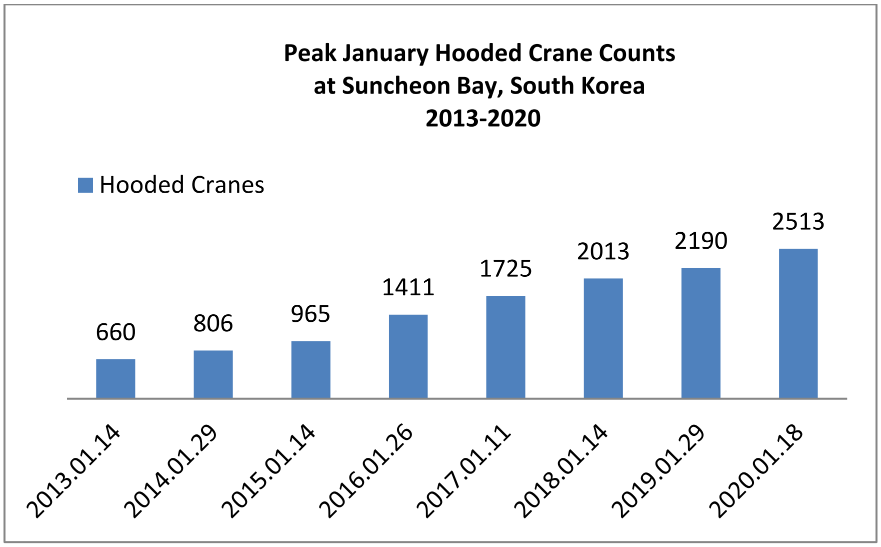


Figure 3.5. Peak hooded crane counts at the Suncheonman Bay Wetland Reserve in January during the winter residency period, 2013-2020. Source: Kang Naru, personal communication, 10 June 2020.

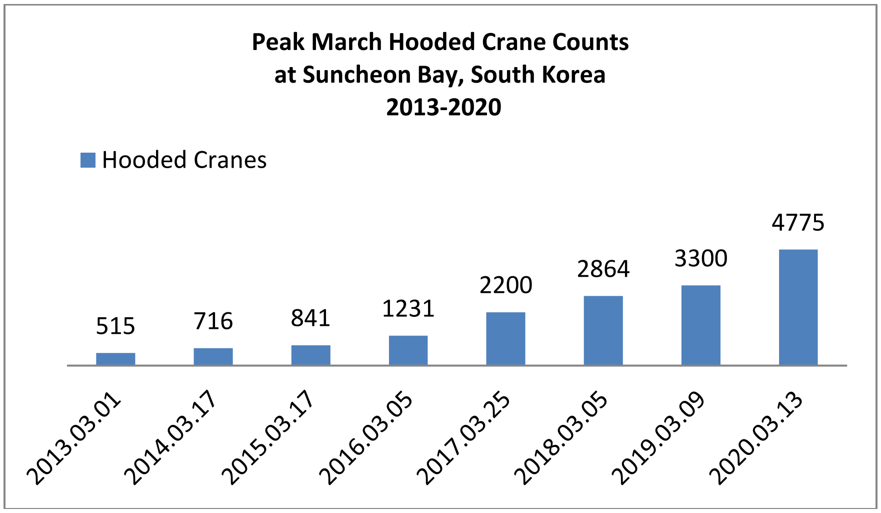


Figure 3.6. Peak hooded crane counts at the Suncheonman Bay Wetland Reserve in March on northward migration from Izumi, Japan, 2013-2020. Source: Kang Naru, personal communication, 10 June 2020.

Southern Japan’s Kyushu Island. There, hooded cranes overwinter in far larger numbers than at Suncheon Bay (Fig. 3.7)(also see Section 7, below). In March each year, the number of hooded cranes at Suncheon Bay briefly surges as cranes returning from Izumi stopover on their way to northern breeding grounds, reaching a high count of 4775 cranes in March 2020 (Table 3.3, Fig. 3.6).

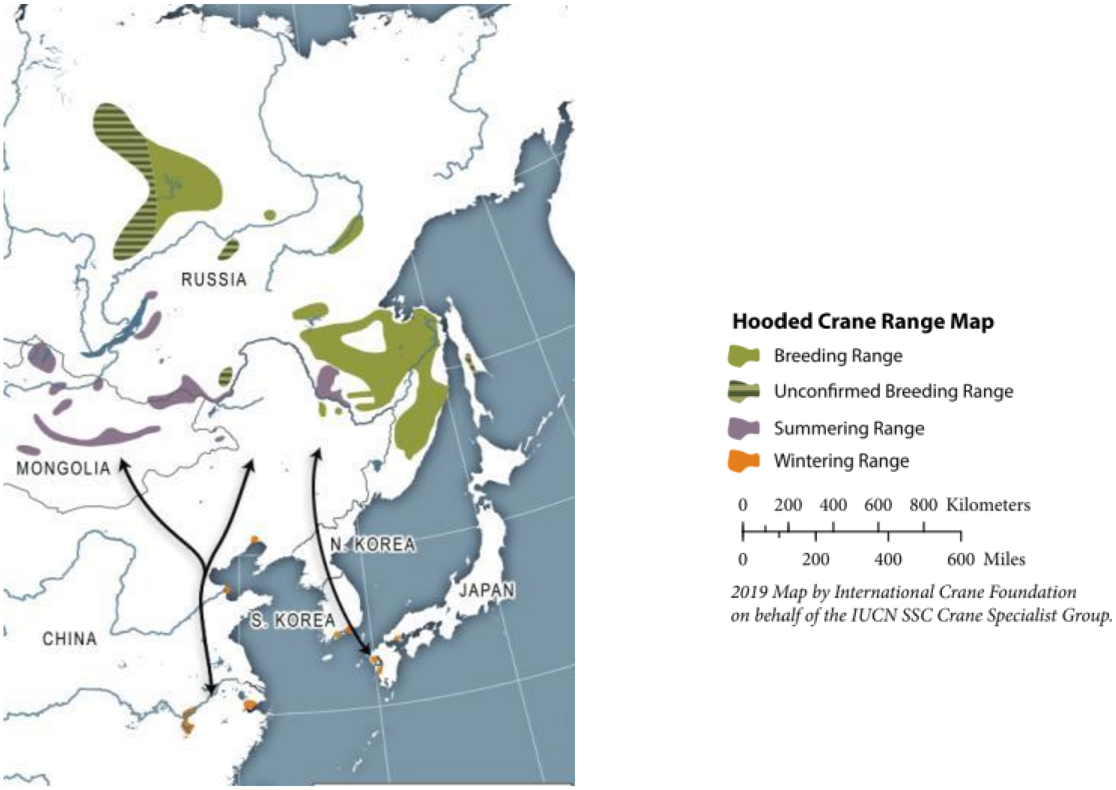

RUSSIA
MONGOLIA
CHINA
N. KOREA
S. KOREA
JAPAN
Hooded Crane Range Map
Breeding Range
Unconfirmed Breeding Range
Summering Range
Wintering Range
0 200 400 600 800 Kilometers
0 200 400 600 Miles
2019 Map by International Crane Foundation on behalf of the IUCN SSC Crane Specialist Group.

Figure 3.7. Hooded crane range map showing migration routes from breeding grounds in Northeast Asia to Suncheon Bay, South Korea; Izumi, Japan; and the Lower Yangtze River, China. Source: Mirande and Harris, 2019.

3.2. Field Methods

A two-day visit was made to the Suncheon Bay Wetland Reserve from January 2-3, 2020. No formal crane or waterbird counts were made at Suncheon Bay during this visit as a complete reserve count was conducted three days earlier on December 30, 2019 (Table 3.1). In general crane counts at Suncheon Bay are done using a spotting scope from fixed point locations with good vantages, such as the upper floor of the bird hide and from the roof of the visitor center. These counts are supplemented with spot counts along the network of roads through the reserve's rice paddies (Fig. 3.3). During this visit, moving observations were made on foot along the farm roads from the greenhouses west of the visitor center to and along the sea dike walkway on the edge of the bay as well as on the reed bed boardwalks and Yongsan Mountain path. Fixed point observations were made from the roof of the Suncheon Bay visitor center as well as from the upper floor of the bird hide overlooking the main crane feeding grounds next to the Dongcheon River. Moving observations were also made during an approximately 30-minute tourist boat ride along the Dongcheon River from near the visitor center to its mouth.

3.3. Results

3.3.1. Suncheon Bay: Day 1 – January 2, 2020

Upon my arrival at the Suncheon Bay Wetland Reserve around 10:30 AM, I was given a PowerPoint presentation on the history, management, and current status of the reserve, its cranes, and other waterfowl by the reserve ornithologist, Kang Naru. Afterwards, I was given a tour of the excellent reserve visitor center and observation deck which had views of hundreds of feeding hooded cranes in the rice paddies to the south. After lunch, from 1:05 PM to 3:30 PM, I made my way on foot from the visitor center, west along the main road to the greenhouse area, and south through the greenhouses and rice paddies in the center of the reserve to the sea dike walkway. The main body of feeding cranes and geese was 800 m directly to the east, in the rice paddies covering a half kilometer wide swath on the west bank of the Dongcheon River. Nevertheless, I did get good looks at a scattering of 21 hooded cranes, primarily family groups, feeding in the rice stubble along my route. Other notable birds sighted included four cinereous vultures, a common kestrel (*Falco tinnunculus*), eight whooper swans (*Cygnus Cygnus*), both rustic and elegant buntings (*Emberiza rustica*, *E. elegans*), and a northern goshawk (*Accipiter gentilis*) seen in flight (also see Appendix 2). Back at the visitor center, we walked down a path along the river to the bird hide, which is only open to the public with guided tours. From the upper floor of the hide, there were excellent views of hundreds of feeding hooded cranes (>500), hundreds of greater white-fronted geese, and hundreds of bean geese. Also sighted were seven white-naped cranes amidst the dense flock of hundreds of feeding hooded cranes as well as two common cranes, and a forlorn looking lone sandhill crane, far from the species main North American wintering grounds in the United States and Mexico. Mammal sightings included a fluffy leopard cat in a winter coat that appeared out of the reeds and a lone water deer. As the sun set, we watched the cranes and geese depart in groups to their roosting sites in the bay. Finally, in the fading light of day, a dark cloud of thousands of Baikal teal swirled over the estuary as their feeding pattern is reverse of that of the cranes and geese, spending the day on the estuary and feeding at night in the rice paddies.

3.3.2. Suncheon Bay: Day 2 – January 3, 2020

I arrived at the Suncheon Bay Visitor Center in the dark about 6:30 AM and repeated the previous day’s walk through the greenhouses to the sea dike walkway, then continued west to the bridge across the Isacheon River (Fig. 3.3). As dawn broke over the bay, the sea and mountains slowly came into view on a sunny morning. Just before and after sunrise at 7:42 AM, I was able to see a number of hooded crane groups flying out from roosting sites in the bay to spend another day feeding in the rice stubble. I also observed another water deer as I walked east along the sea dike, finding Kang Naru at 8:00 AM with his spotting scope where the main road through the rice paddies ends at the sea dike. After breakfast at the visitor center, at 9:00 AM we walked across the river foot bridge, down the reed bed boardwalk to the Yongsan Mountain trail and observatory. Along the way, we saw a variety of water birds, including many eastern spot-billed ducks and mallards, common mergansers (*Mergus merganser*), and hundreds of Baikal teal. After taking in the bay views from the observatory, we walked back to the visitor center, seeing some otter tracks in the mud below the boardwalk, arriving about 11:30 AM. We took the noon tourist boat along the river for a close up look at thousands of ducks, both on the mudflats and in the water. Highlights included about 200 common shelducks (*Tadorna tadorna*), a pair of northern pintails (*Anas acuta*), and four Eurasian curlews (*Numenius arquata*), and a pass through a swirling cloud of hundreds of Baikal teal. After a quick lunch break, I took a walk upriver along the reedbeds seeing elegant buntings and a flock of 25 or so vinous-throated parrotbills (*Paradoxornis webbianus*). I finished my observations about 2:00 PM and departed the reserve for the train station at about 2:30 PM after being briefly greeted by the mayor of Suncheon and his entourage.

3.4. Discussion

Since crane counts first began at Suncheon Bay, the number of cranes wintering at the bay has increased from 70 in 1996 to 2513 in January 2020, with the crane population surging rapidly after 2012 following restoration of the mudflat habitat where cranes roost. At the same time, the number of white-naped cranes wintering at Suncheon Bay appears to be declining, with a peak count of 35 having been made in 2014, but only 10 counted in December 2019 (Kang Naru, personal communication, 10 June 2020). However, populations of white-naped cranes in the Korean Demilitarized Zone (DMZ) are increasing, likely due to declining snow cover in the north of the ROK as a result of climate change (see Section 6). Thus, most white-naped cranes en route to Izumi along the Korean Peninsula clearly bypass Suncheon Bay (see Section 7).

At present, perhaps the largest existential threat to cranes at Suncheon Bay is rising sea level, which threatens to eliminate shallow water roosting areas on the bay's tidal mudflats. As of 2016 cranes were already having difficulty staying the entire night on these mudflats during particularly high tides (Smith, 2019). Although there is a sea dike protecting the main rice paddy feeding grounds, it remains to be seen how rising tides and possible accompanying salt-water intrusion will affect these feeding areas. As at Poyang Lake, Izumi, Cheorwon, and elsewhere, a second large concern is simply the sheer concentration of Korea's hooded cranes at the Suncheon Bay reserve as they abandon other range areas in South Korea. Thus, concentrated at Suncheon in large numbers, these cranes are susceptible to falling victim to an avian epidemic, severe weather event, or loss of habitat due to rising sea level. Another concern is the rapid pace of development in the Suncheon region, including the construction of new businesses along the bay, setting up of greenhouses on rice paddies used by cranes, and the expansion of local powerline networks that pose a flight hazard to cranes (Mirande and Ilyashenko, 2019b).

Beyond habitat protection and restoration, other factors contributing to the dramatic increase of cranes at Suncheon Bay include: 1) artificial feeding of cranes at Suncheon throughout winter and 2) development of hydropower dams on the Nakdong River, some 130 km to the east. At present, the reserve feeds the local crane population about 300 kg of grain per day during the winter crane residency period, generally rice (SBWR, 2018; Kang Naru, personal communication, 10 June 2020). This grain is scattered in the reserve's rice paddies and works out to about 125 grams of grain per day per crane, although in reality the large wild goose and duck population also feeds on this grain. While clearly benefiting the local crane population, which require about 1000 grams of food per day (Yuko Haraguchi, personal communication, 16 January 2020), this grain serves as a powerful attractant for cranes. Thus, cranes are increasingly concentrated at Suncheon Bay when, in the absence of artificial feeding, they might perhaps be more widely distributed in farmlands along the southern tip of the Korean Peninsula.

Another reason believed to be contributing to the growth of crane numbers at Suncheon Bay has been the development of the Nakdong River basin. The Nakdong River empties into the sea at

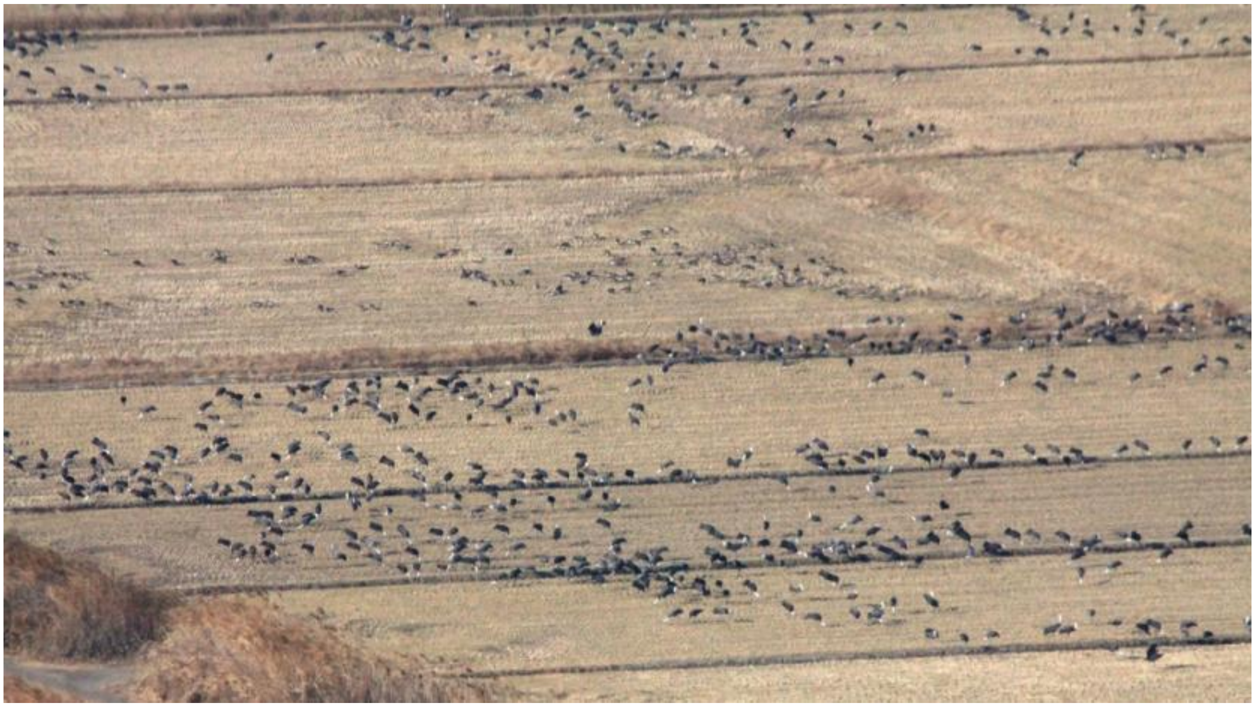


Figure 3.8. Hooded cranes (top and bottom) and greater white-fronted geese (middle) feeding in dry rice stubble, Suncheonman Bay Wetland Reserve, South Korea.

Busan and is South Korea's longest river with a length of 506 km (Wikipedia, 2020a). The river trends from north to south and was formerly an important crane migration corridor. However, in the 1970s, the river began to be developed for hydropower with the construction of a series of dams. The largest of these is the Andong Dam on the upper Nakdong, which was built from 1971 to 1976 (Wikipedia, 2020b). Following completion of these dams, scouring of sand bars and beaches below the dams as a result of sediment blockage has irreparably damaged the river's value as migratory crane habitat. And it is believed that more cranes now track further west on migration, bringing them to Suncheon Bay instead (Kang Naru, personal communication, 2 January 2020). Thus, solutions will need to be found to encourage hooded cranes to reoccupy former winter sites on the southern Korean Peninsula.

4. Ganghwado Mudflats

Ganghwa County, Incheon Municipality, South Korea

Date Visited: January 4, 2020

4.1. Site Description and Background

Ganghwado Island (강화도) is located about 45 km northeast of Seoul in Incheon Municipality, being situated at the mouth of the Han River on the Yellow Sea (Figs. 1.1, 4.1, and 4.2). The island is about 25 km long and covered in a patchwork of forested hills, agricultural fields, and villages. The highest point on the island is the 469-meter high Manisan mountain. At the southern end of the island is a large tidal mudflat that is part of the enormous Yellow Sea mudflat complex, one of the world's largest tidal mudflat ecosystems (Figs. 4.1. 4.2, and 4.3). The Ganghwado Mudflats (37°36'02.23"N, 126°31'08.49"E) are the winter home of a small population of red-crowned cranes as well as moderate numbers of other waterbirds (for a video overview of these mudflats, see Lee, 2020a,b, and c). An early red-crowned crane survey at Ganghwado in 1999 counted 10 individuals, a level at which crane numbers remained relatively stable until the winter of 2008 when the population began to increase (Table 4.1)(Park, 2008; Lee, 2009)

Table 4.1. Red-crowned Crane Counts on the Ganghwado, 1999-2008

Year	Red-crowned Crane Count	Year	Red-crowned Crane Count
1999	10	2004	No Data
2000	No Data	2005	10
2001	11	2006	13
2002	10	2007	7
2003	2	2008*	15-20

Sources: Park, 2008; *Lee, 2009.

In the southeast corner of Ganghwado, separated by a 350 m long bridge over the mudflats, is the small two kilometer-long Donggeom-ri Island. This island has a paved road along its northeast side that provides excellent views of crane feeding areas on the mudflats (Figs. 4.1 and 4.3). Here, red-crowned cranes can be seen hunting small fish, mudskippers, crabs, and other invertebrates. In addition, a small amount of corn is also spread for cranes along the stone jetty at Stop #2 in Fig. 4.3. Cranes roost nearby on smaller uninhabited islands scattered across the mudflats. Notably, about 30 black-faced spoonbills nest along the mudflats in summer while 167 Black-faced Spoonbills were counted along Ganghwado in September 2002 (Paik et al., 2010; Yeo Sang Kyeong, personal communication, 4 January 2020).

4.2. Field Methods

A short half day visit was made to the Ganghwado Mudflats on January 4, 2020 as part of a joint monthly Eco-Education Hub Waterfowl Egg/Ganghwa Bird Watching Club Saturday program. Brief 10 to 30-minute fixed point observations were made at the six locations shown in Fig. 4.3, where cranes and other waterbirds were counted (Table 4.2).

4.3. Results

4.3.1. Ganghwado – January 4, 2020

In total, 32 red-crowned cranes were counted at the six stops made along the Ganghwado Mudflats, with the largest site count being 17 cranes counted at Stop #6, which was a concrete pier structure built out onto the mudflats (Table 4.2). Seven cranes were counted at the Huaedondae Outpost (Fig. 4.3). Built in 1679, the Huaedondae site is the ruin of a coastal outpost of the larger Seondubo Fort. In addition to red-crowned cranes, other waterbird species sighted included mallards, eastern spot-billed ducks, common shelducks, and vega gulls (*Larus vegae*) (also see Appendix 2).

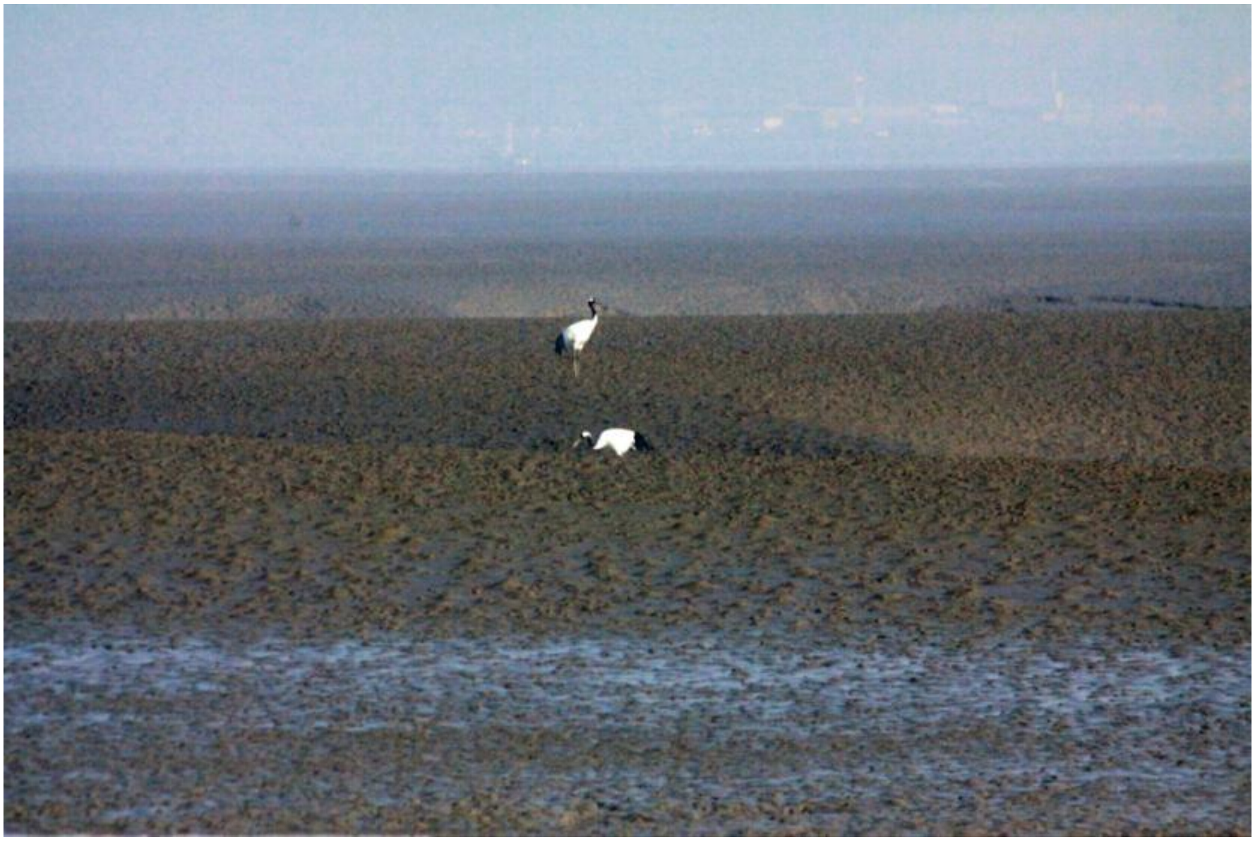


Figure 4.1. Red-crowned cranes, Ganghwado Mudflats, Donggeom-ri Island, Incheon Municipality, South Korea**.**

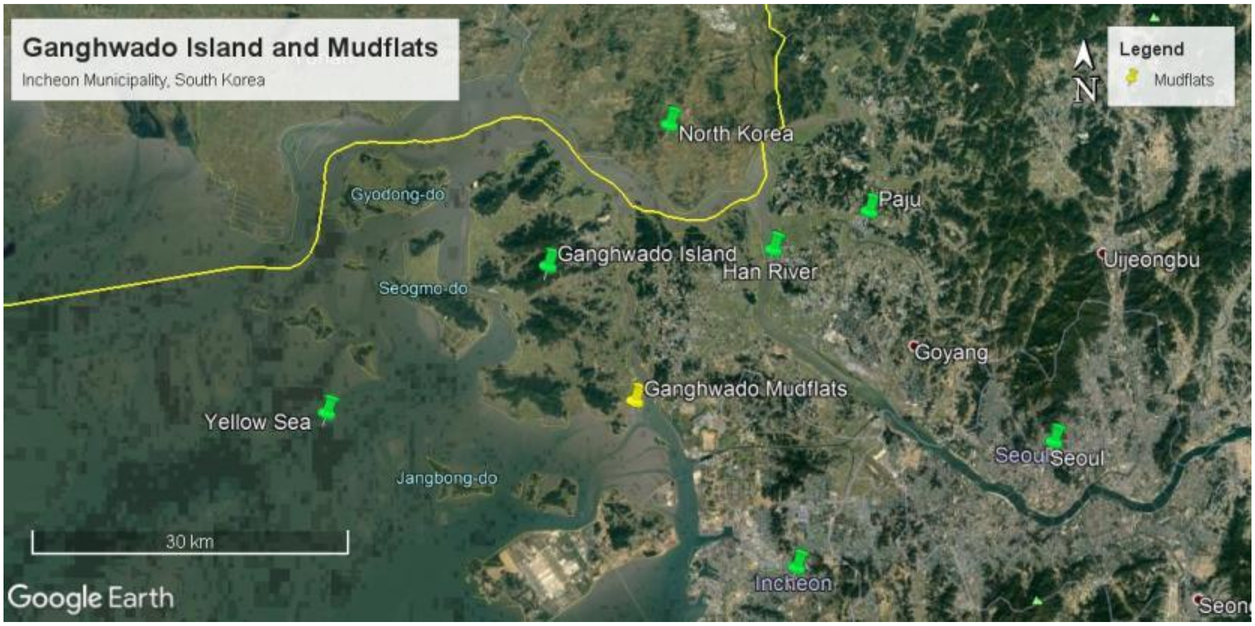


Figure 4.2. Overview of the Ganghwado Mudflats, Incheon Municipality, South Korea**.**

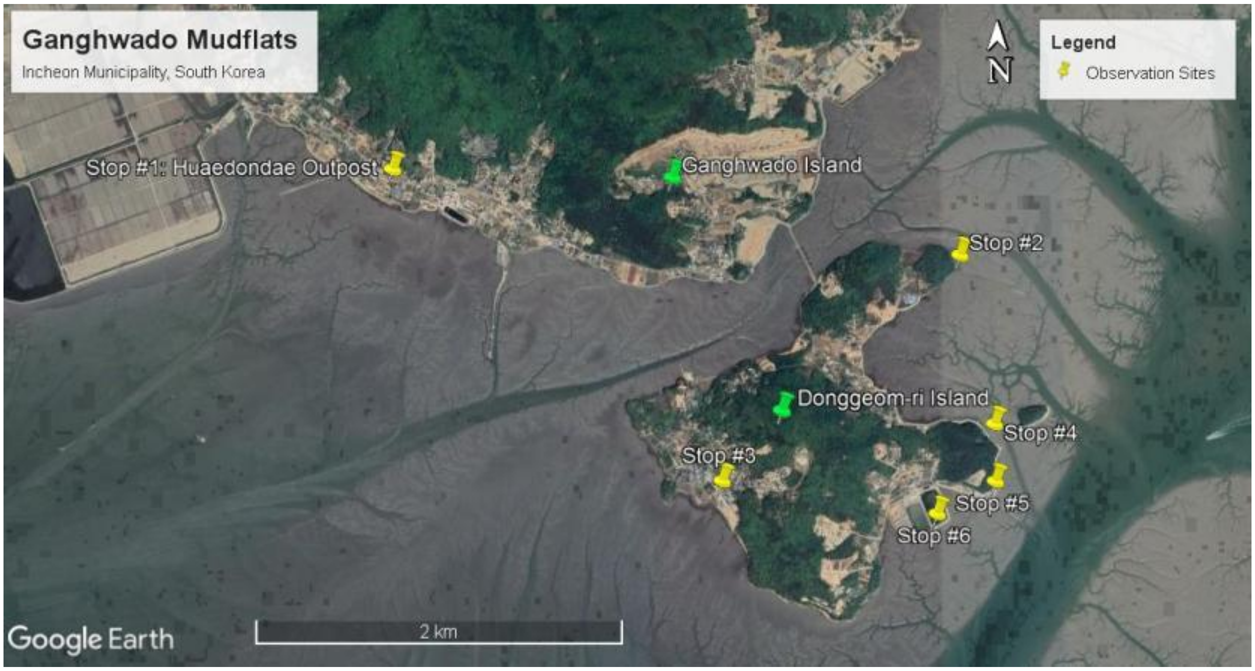


Figure 4.3. Red-crowned crane observation sites visited along the Ganghwado Mudflats on Ganghwado and Donggeom-ri Islands, Incheon Municipality, South Korea, January 4, 2020.

Table 4.2. Red-crowned Crane Counts on the Ganghwado Mudflats, January 4, 2020.

Observation Location	**Location (Korean)**	**Latitude**	**Longitude**	**Red-crowned Crane Count**
Stop #1: Huaedondae Outpost, Ganghwado Island	후애돈대, 강화도	37°36'4.94"N	126°29'19.35"E	7
Stop #2: Donggeom-ri Island	동검리	37°35'49.50"N	126°31'25.07"E	3
Stop #3: Donggeom-ri Island	동검리	37°35'10.01"N	126°30'32.03"E	3
Stop #4: Donggeom-ri Island	동검리	37°35'19.78"N	126°31'32.48"E	2
Stop #5: Donggeom-ri Island	동검리	37°35'9.67"N	126°31'32.74"E	0
Stop #6: Donggeom-ri Island	동검리	37°35'3.97"N	126°31'19.85"E	17
Total Count				**32**

4.4. Discussion

Although rice paddy fields do occur adjacent to the Ganghwado Mudflats, during this visit, red-crowned cranes were only seen feeding on live food on the mudflats. And while 32 cranes were counted on January 4th, a more complete survey of Ganghwado conducted by the National Institute of Biological Resources (NIBR) on January 19, 2020 produced a count of 44 red-crowned cranes (Table 1.1)(NIBR, unpublished data). Thus, crane numbers at Ganghwado have roughly quadrupled since formal surveys began in 1999.

Threats to cranes at the Ganghwado mudflats include sea level rise, which may ultimately result in loss of tidal flat feeding grounds and roosting sites (Smith, 2019). Another threat that is reducing crane habitat around the mudflats is the rapid pace of development in the area, including reclamation of mudflat and salt marsh areas and construction of new housing (Lee, 2009; Smith, 2019).

5. Yeoncheon County

Gyeonggi Province, South Korea

Date Visited: January 7, 2020

5.1. Site Description and Background

Yeoncheon County (연천군, 38°05'47.00"N, 127°04'29.19"E) is located about 60 km north of Seoul on the border between North and South Korea (Figs. 1.1, 5.1, and 5.2). It is currently South Korea's second most important wintering ground for endangered red-crowned and vulnerable white-naped cranes after neighboring Cheorwon County. Crane feeding and roosting areas in Yeoncheon are concentrated along a 17 km long reach of the Imjin River, from the vicinity of the Gunnam Dam, located 5 km directly west of Yeoncheon Town, upstream to the point where the river flows out of North Korea (Figs. 5.1, 5.2, and 5.3). This area is located almost entirely within the Civilian Control (CCZ) and Demilitarized Zones (DMZ), thus is relatively free of human disturbance in comparison to the rapid pace of development elsewhere in Yeoncheon County. Terrain in the crane areas is dominated by the narrow Imjin River Valley which is lined with rolling hills covered in a patchwork of agricultural fields, shrublands, and forest (Fig. 5.1). This valley is considered by some to be the most scenic crane area in South Korea.

One local agricultural specialty at this site is a grain native to Southeast Asia known as "Job's tears" (*Coix lachrymal-jobi* var *ma-yuen*) or "adlay" in English, which is grown along the Imjin River and is an important winter food source for cranes together with freshwater snails found in the river (Lee, 2009). A series of artificial feeding stations for cranes have been set up along the river which consist of cleared fields on relatively flat areas where Job's tears and rice are spread on the ground for cranes (Figs. 5.4 and 5.6). In the winter of 2018 to 2019, cranes at these feeding stations were fed a total of 1400 kg of Job's tears and 1200 kg of rice (Baek et al., 2019).

The Yeoncheon Imjin River site provides winter habitat for a globally significant number of eastern red-crowned and white-naped cranes which migrate from breeding grounds in the Russian Far East and Northeast China to winter in the DMZ (Figs. 5.7 and 5.8). However, about 20 to 25 percent of the eastern white-naped crane population continues southward to Izumi, Japan (Fig. 5.8). Researchers were not aware of the importance of the Yeoncheon Imjin River crane sites until relatively recently. Thus, there were no crane surveys conducted in this area until the 2000s (Lee, 2009). However, as at Suncheon Bay, crane numbers at Yeoncheon have increased dramatically during the first two decades of the 21st Century, with red-crowned crane numbers growing from about 75 in the winter of 2003-2004 to 396 in January 2020 (Table 5.1, Fig. 5.5)(Lee, 2009; NIBR unpublished data). At the same time, white-naped crane numbers grew from 125 in January 2015 to 507 in January 2020 (Table 5.1)(Baek et al., 2019; NIBR, unpublished data). Crane conservation activities in Yeoncheon are funded by the Yeoncheon County government and are currently being led by an autonomous organization known in

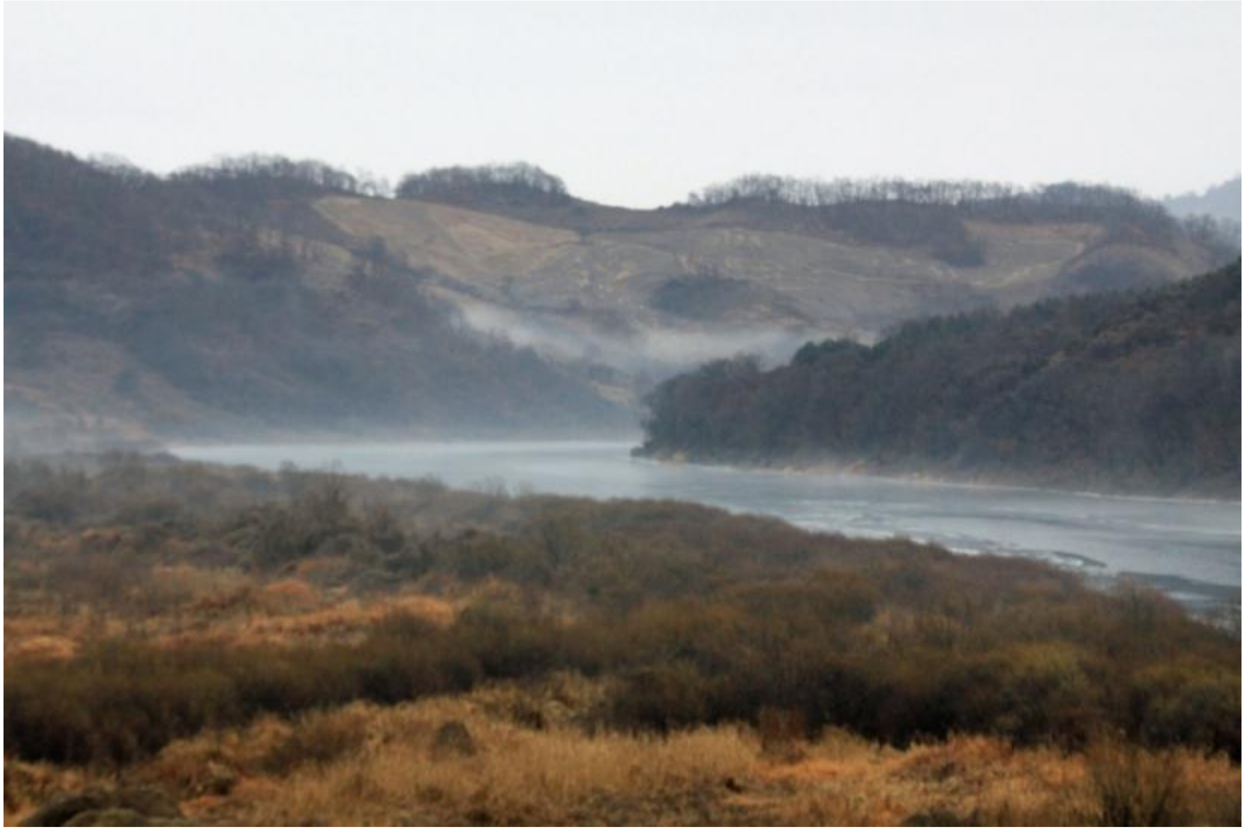


Figure 5.1. The Imjin River near the Yeoncheon bird hide, Yeoncheon County, Gyeonggi Province, South Korea.

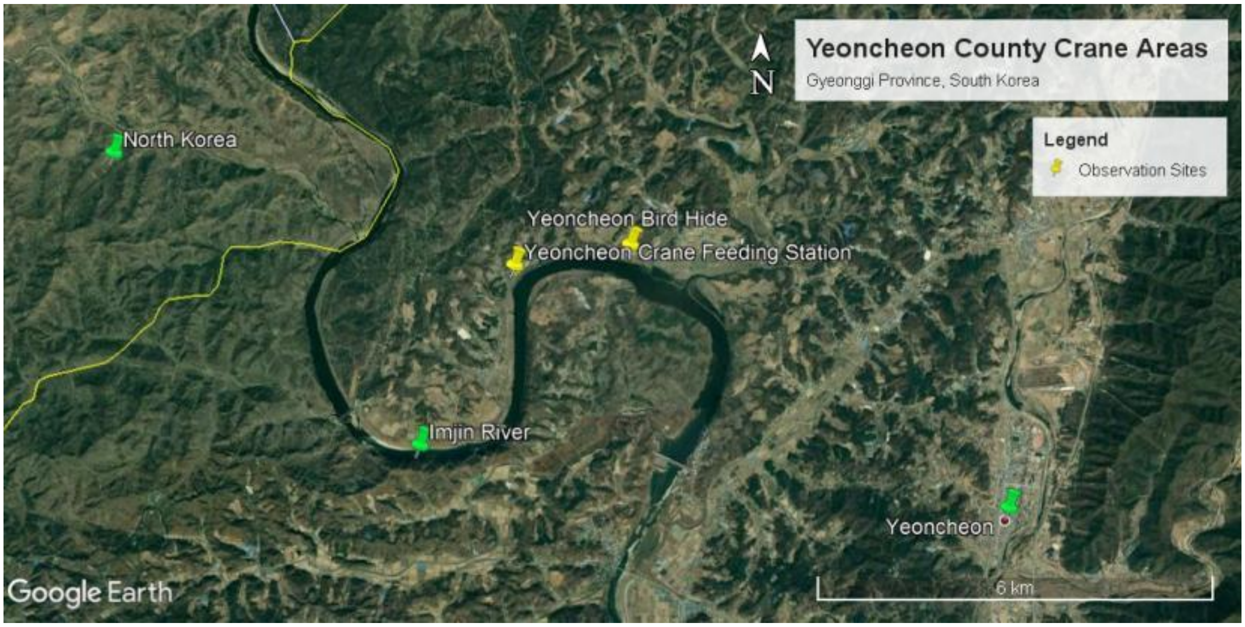


Figure 5.2. Overview of Yeoncheon County crane areas along the Imjin River, Yeoncheon County, Gyeonggi Province, South Korea.

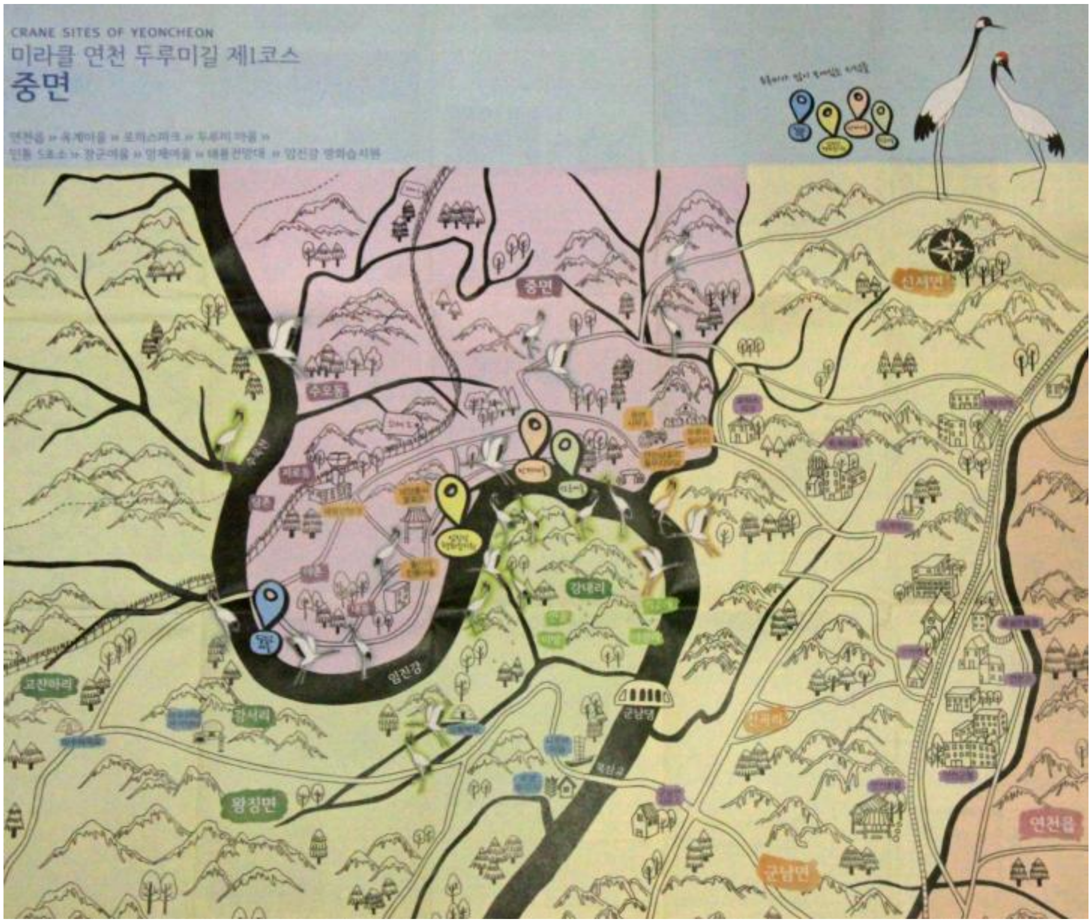


Figure 5.3. Yeoncheon County tourist map providing an overview of crane sites, Yeoncheon County, Gyeonggi Province, South Korea. Source: Yeoncheon County, 2019.

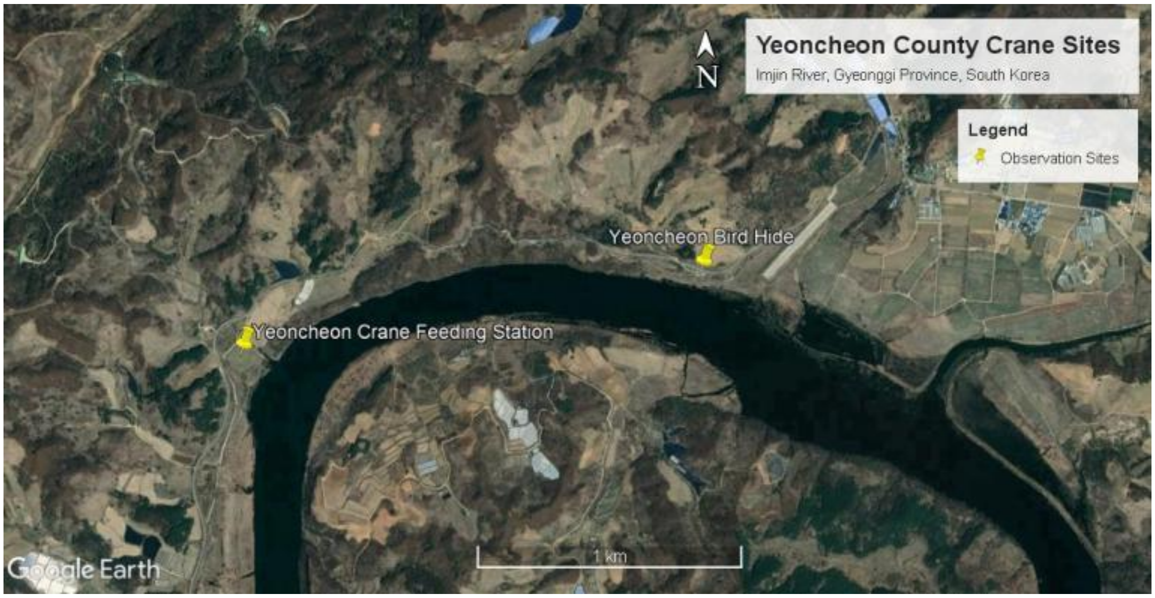

Yeoncheon County Crane Sites
Imjin River, Gyeonggi Province, South Korea
N
Legend
Observation Sites
Yeoncheon Bird Hide
Yeoncheon Crane Feeding Station
1 km
Google Earth

Figure 5.4. Yeoncheon County crane sites visited on January 7, 2020.

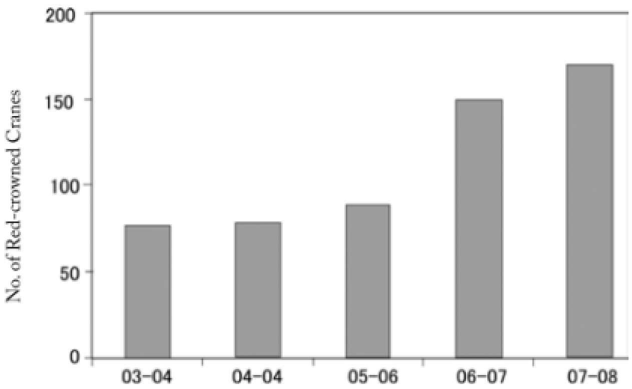


Figure 5.5. Red-crowned crane counts at Yeoncheon, 2003-2008. Source: Lee, 2009.

Table 5.1. Red-crowned and white-naped crane December and January high counts at Yeoncheon, 2006-2019.

Date	Red-crowned Crane	White-naped Crane
December 2006[1]	150	—
January 2008[1]	170	—
January 2015[2]	158	125
January 2018[2]	278	282
January 2019[2]	276	311
January 17, 2020[3]	396	507

Source: [1]Lee, 2009; [2]Baek et al., 2019; [3]NIBR, unpublished data.

English as “Clean Hantan River”, which conducts crane research, implements conservation actions, and organizes community crane programs. None of the crane areas in Yeoncheon are formally protected. Another fairly common avian sight along this stretch of the Imjin River in winter is the white-tailed eagle (*Haliaeetus albicilla*)(also see Appendix 2).

5.2. Field Methods

No systematic count was conducted at Yeoncheon during this visit, which, due to an African swine flu outbreak in the DMZ, was limited to a one-hour drive from 11:00 AM to 12:00 PM. The two crane sites visited were the Imjin River bird hide and feeding station shown in Figs. 5.2 and 5.4. However, local researchers regularly conduct full crane surveys using spotting scopes and binoculars at fixed points as well as making opportunistic counts of cranes sighted while driving along the Imjin River (e.g. see Baek et al., 2019).

5.3. Results

5.3.1. Yeoncheon County – January 7, 2020

Results of counts made during the brief visit along the Imjin River in Yeoncheon are summarized in Table 5.2. The 57 red-crowned cranes and 109 white-naped cranes sighted

Table 5.2. Red-crowned and White-naped Crane counts on the Imjin River, Yeoncheon County, January 7, 2020.

Observation Location	Location (Korean)	Latitude	Longitude	Red-crowned Crane Count	White-naped Crane Count
Yeoncheon Feeding Station, Imjin River	임진강	38° 7'46.67"N	126°59'21.25"E	55	105
Yeoncheon Bird Hide, Imjin River	임진강	38° 7'56.77"N	127° 0'33.60"E	2	4
Total Count				57	109

amount to about 14 percent and 21 percent of the January 2020 high counts for these species, respectively (Table 5.1). In addition, four white-tailed eagles were seen flying along the Imjin River as well as several other bird species as detailed in Appendix 2. Complete data on dozens of winter crane counts conducted at Yeoncheon from October 2014 to March 2019 can be found in Baek at al., 2019.

5.4. Discussion

In spite of the rapid pace of development in Yeoncheon County, crane numbers have steadily risen since systematic crane counts began there in 2003 (Fig. 5.5, Table 5.1)(Lee, 2009; Baek at al., 2019). Red-crowned crane numbers at Yeoncheon underwent an over fivefold increase between 2003 and 2020 while white-naped crane numbers experienced an over fourfold increase between just 2015 and 2020 (Table 5.1). This is in contrast to the western white-naped crane population at Poyang Lake which has fallen by two-thirds since 1996 (see Section 2.4).

However, development activities affecting cranes in Yeoncheon include construction of the Gunnam Dam on the Imjin River, which began operating in July 2010. The primary purpose of this dam is to control flash-flooding from unannounced North Korean dam releases, but it also stores water in winter for use in the event of spring drought (YNA, 2016; Momose and Momose, 2019). Although eliminating shallow water feeding areas and roosting sites upstream of the dam, crane populations in Yeoncheon have nevertheless continued to increase (Lee, 2009; Baek et al., 2019).

A second large threat to crane habitat in Yeoncheon has been the ongoing reduction of the area of the CCZ as more of it is opened to economic development activities. This has included more intensive commercial farming activity in the CCZ that has eliminated grain fields favored by cranes for winter feeding grounds. Examples include the introduction of greenhouse and ginseng root farming, the latter of which requires vast areas of fields to be covered by canopies to protect ginseng crops. Another threat to cranes in Yeoncheon is the expansion of the powerline network in farming areas, notably to light greenhouses, which creates a flight hazard for cranes. Increased disturbance to cranes also arises from increasing numbers of tourists, photographers, and bird-watchers visiting Yeoncheon as the local government promotes tourism in the border region (Fig. 5.3)(Mirande et al., 2019).

Given the growing number of threats to red-crowned and white-naped cranes in Yeoncheon County, why have crane numbers there continued to increase? A number of reasons have been suggested, although it is impossible to determine the contribution of each to overall increases in

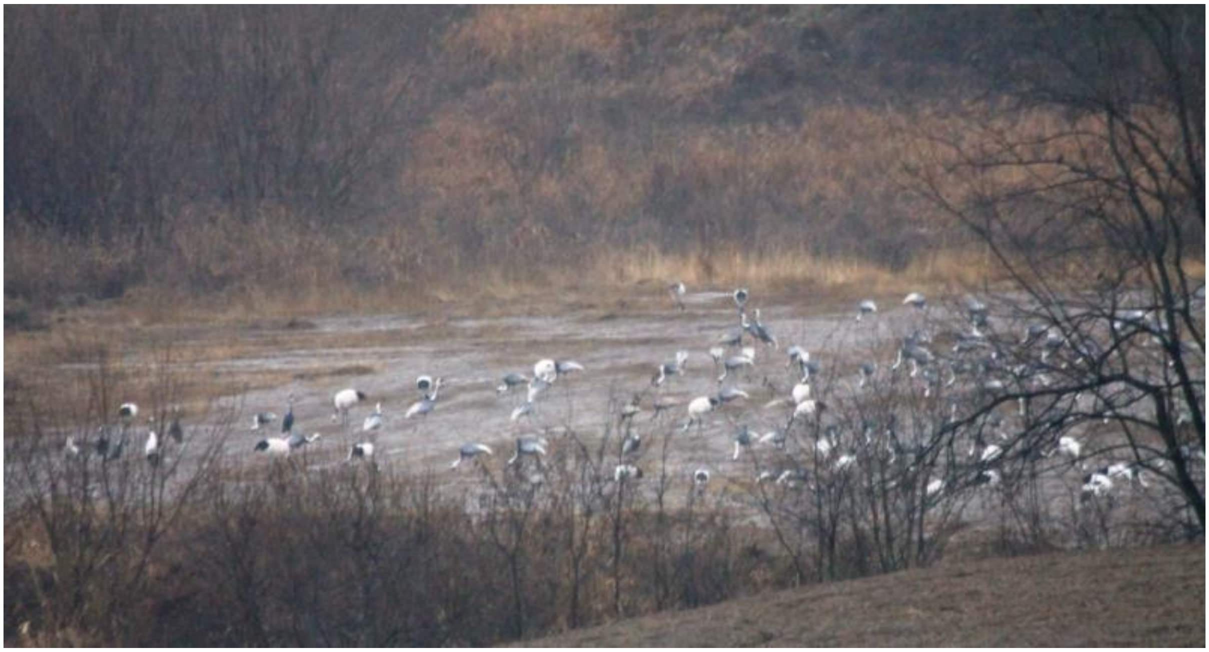


Figure 5.6. White-naped and red-crowned cranes at an artificial feeding station on the Imjin River, Yeoncheon County, South Korea.

crane numbers. One likely reason is the general decline of agriculture in North Korea (Lee, 2009). Although no studies have been performed, it is assumed that former red-crowned crane winter sites in North Korea are no longer occupied by cranes due to a lack of food, which may be leading them to winter further south across the border in the South Korean side of the DMZ. With respect to white-naped cranes, many no longer appear to be migrating all the way to Izumi in southern Japan, instead spending the winter in the north of the ROK (Mirande et al., 2019). This may be due to a decline in annual snow cover days in South Korea that has accompanied global warming (Kisup Lee, personal communication, January 2020).

A third important reason is undoubtedly the establishment of government-supported crane feeding stations along the Imjin River in the CCZ and DMZ, where in the winter of 2018-2019, Clean Hantan River spread 1400 kg of Job's tears as well as 1200 kg of rice for cranes (Baek et al., 2019). However, a new crane watching hide and feeding station on the Imjin River that was funded by the local power company has attracted very few cranes (Fig. 5.4). When we visited this site on January 7, 2020, only six cranes were present (Table 5.2). Thus, it may be better to focus feeding efforts on areas already know to attract cranes. Baek et al. (2019) provide additional detailed data on the amount of grain spread in winter for cranes, spreading dates, and locations from November 2014 until February 2019. In an effort to reduce disturbance to cranes from tourists, photographers, and birdwatchers at crane feeding stations on the Imjin River, Clean Hantan River has set up mesh fencing along the road at these sites to discourage visitors from getting too close to feeding cranes.

A fourth reason for increasing crane numbers in Yeoncheon may be the decline of western white-naped crane breeding grounds in and around the steppes of eastern Mongolia due to an increasing frequency of drought, which may be leading this species to shift from its western to its eastern flyway (Fig. 5.8)(Mirande et al., 2019). Presumably western red-crowned crane populations are also being affected by drought in the western part of their range, as well as other development activities (Momose and Momose, 2019). All of these reasons for increasing crane populations at Yeoncheon also apply to South Korea's neighboring Cheorwon County, as discussed in the next section.

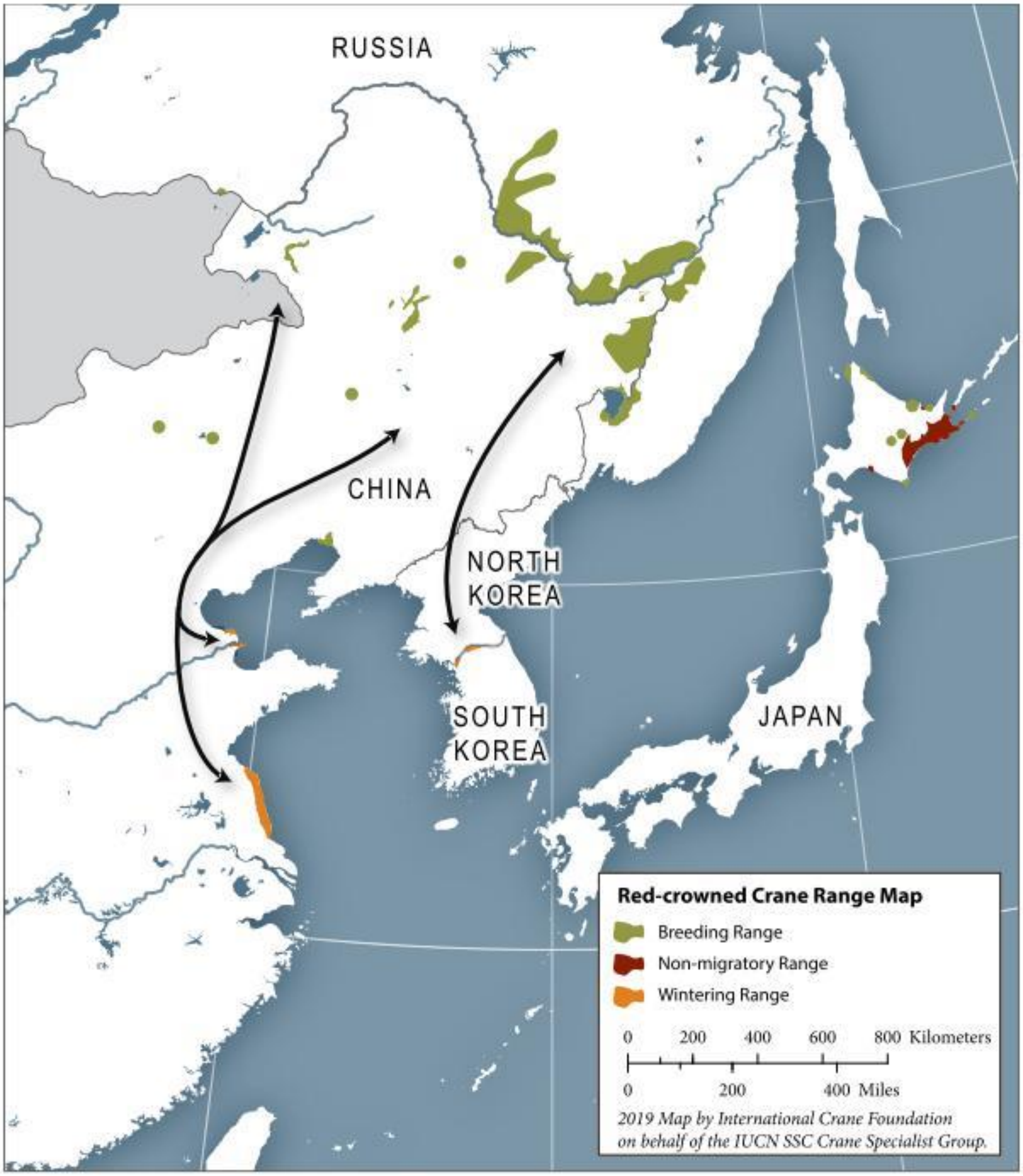
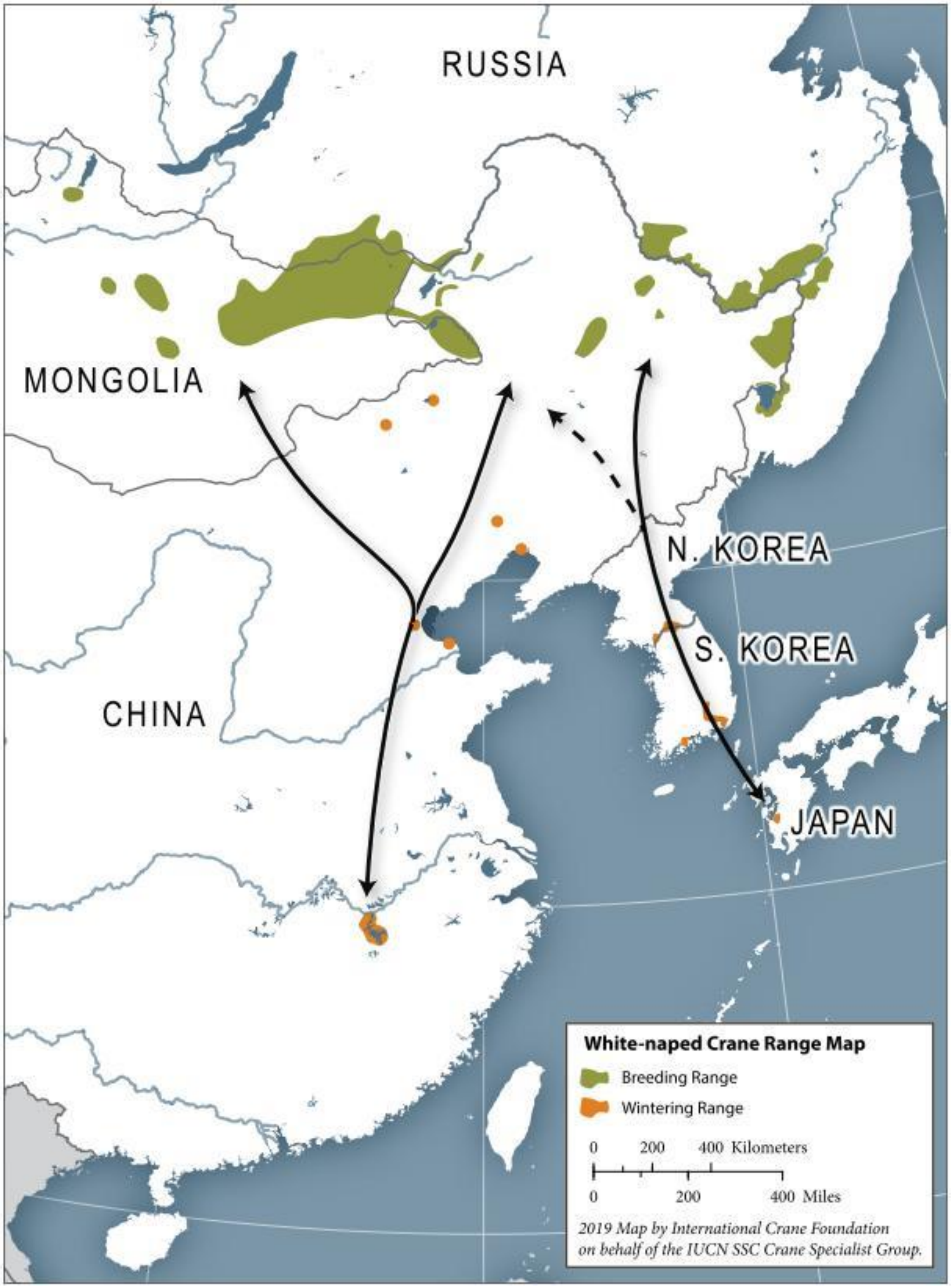

RUSSIA
CHINA
NORTH KOREA
SOUTH KOREA
JAPAN
Red-crowned Crane Range Map
Breeding Range
Non-migratory Range
Wintering Range
0 200 400 600 800 Kilometers
0 200 400 Miles
2019 Map by International Crane Foundation on behalf of the IUCN SSC Crane Specialist Group.

Figure 5.7. Red-crowned crane range map showing migration routes of the eastern and western populations from their breeding grounds to wintering areas on the Korean Peninsula DMZ and the Yancheng and Yellow River Delta National Nature Reserves in China. Source: Mirande and Harris, 2019.


RUSSIA
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JAPAN
White-naped Crane Range Map
Breeding Range
Wintering Range
0 200 400 Kilometers
0 200 400 Miles
2019 Map by International Crane Foundation on behalf of the IUCN SSC Crane Specialist Group.

Figure 5.8. White-naped crane range map showing migration routes of the eastern and western populations from their breeding grounds to wintering areas in Korea, Japan, and China. Source: Mirande and Harris, 2019.

6. Cheorwon County

Gangwon Province, South Korea

Dates Visited: January 6-8 and 12, 2020

6.1. Site Description and Background

Cheorwon County (철원군, 38°12'26.39"N, 127°13'7.18"E) is located about 75 km north of Seoul on the border with North Korea, lying just northwest of Yeoncheon County (Figs. 1.1, 6.1, and 6.2). The Cheorwon Basin in the north of Cheorwon County is currently the Korean Peninsula's most important wintering ground for red-crowned and white-naped cranes and has the peninsula's largest winter crane population (Figs. 6.2, 6.3, 6.4, and 6.5, Table 6.2)(Lee, 2009). Globally, the basin is the single most important wintering ground for migratory red-crowned cranes. Crane feeding areas in Cheorwon are concentrated in the broad rice growing areas of the Civilian Control (CCZ) and Demilitarized Zones (DMZ) centered around Ice Cream Hill. Roosting sites are located in the neighboring Hangtang River, small wetlands bordering the basin's rice paddies, and three reservoirs found in the area, namely the Tokyo, Dongsong, and Sanmyeong Reservoirs (Figs. 6.2. 6.3, 6.4, and 6.5, Table 6.1). As a result of its location in the CCZ and DMZ, the area is relatively free of development activities beyond farmland improvements, providing a quiet place for cranes to pass the winter.

Terrain in the Cheorwon Basin is primarily broadly stepped rice paddy terraces with an elevation range of about 200 to 260 m. Interspersed throughout the basin are low hills covered in forest and shrublands as well as small patches of forest and shrubs found amidst agricultural fields, generally along stream drainages. Other features of the area include a number of Korean War era ruins, such as the Woljeong Ri Train Depot. The Cheorwon County-funded DMZ Crane Peace Town Visitor Center is located in the village of Yangji Gil and has excellent crane and bird exhibits. It also serves as the headquarters for crane conservation work in Cheorwon (Figs. 6.2 and 6.5, Table 6.1).

As at Yeoncheon, red-crowned and white-naped crane numbers at Cheorwon have been increasing in recent years (Figs. 6.6 and 6.7, Table 6.2). However, as noted by Lee (2009), some of the earliest year-on-year increase in crane numbers is likely due to improved knowledge of areas occupied by cranes in Cheorwon, improved counting methodologies, and improved access to crane areas as local road networks have been upgraded. Nevertheless, red-crowned crane numbers at Cheorwon seem to be increasing slowly while white-naped crane numbers have increased dramatically. Counts for these species at Cheorwon on January 18, 2020 were 1179 red-crowned cranes and 4573 white-naped cranes (Table 6.2)(NIBR, unpublished data).

The local Cheorwon government provides support to the DMZ Crane Committee, headquartered at the DMZ Crane Peace Town Visitor Center, for crane conservation and public education activities. However, the winter crane areas in Cheorwon have no formal protection. Although

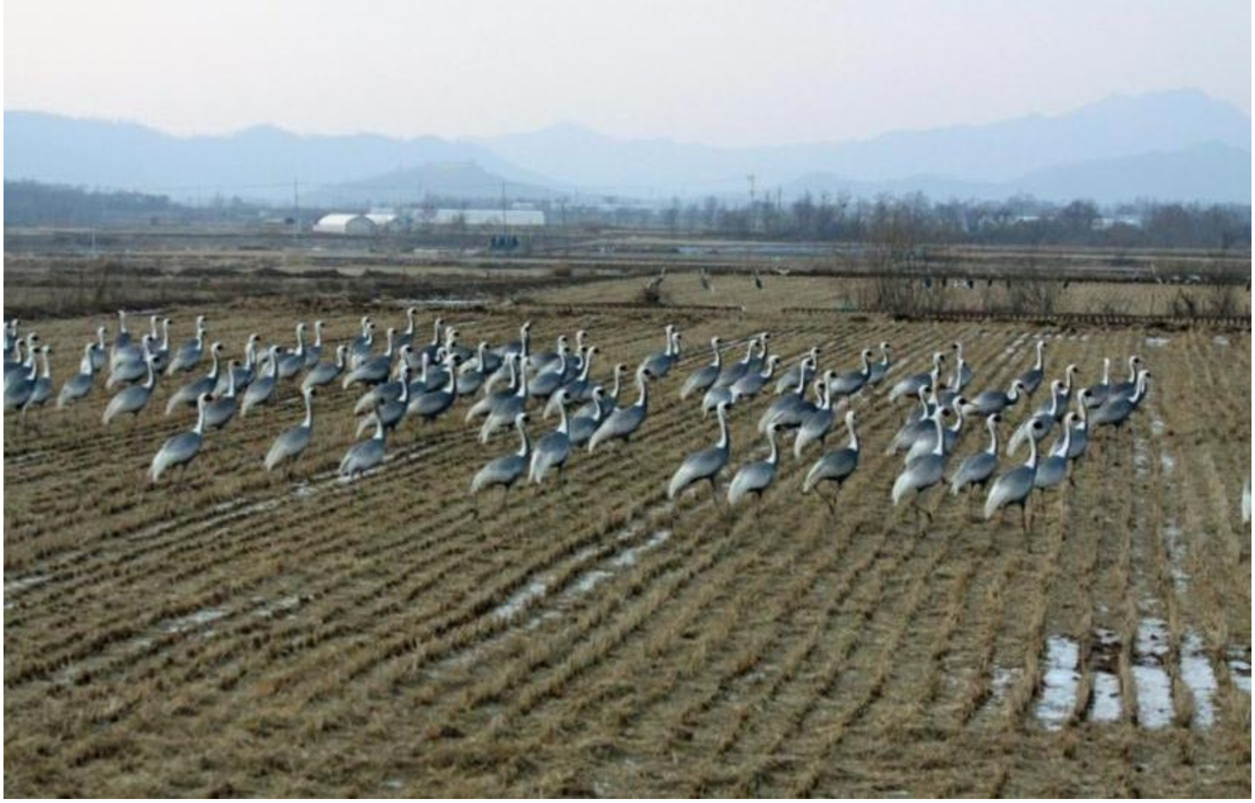

Figure 6.1. White-naped cranes *Grus vipio* feeding in rice stubble near Yangji Gil Village, Cheorwon County, South Korea.

artificial feeding of Cheorwon cranes began in the late 1990s, this practice was curtailed in the mid-2000s due to concerns about spread of avian influenza among concentrated numbers of cranes at feeding stations (Yoo et al., 2011). Thus, at present, cranes are found widely distributed across the Cheorwon basin's rice paddies.

Another notable bird species found at Cheorwon in winter is the greater white-fronted goose, which from the winter of 2002 to the winter of 2011 had a mean high count of 13,482 (Yoo et al., 2011). These geese are found in large rafts on Cheorwon's reservoirs each morning before they fly off in dramatic fashion to spend winter days feeding on rice paddies alongside cranes. Other bird species present in winter include whooper swan, mallard, white-tailed eagle, cinereous vulture, and rustic bunting (also see Appendix 2). Due to its birdlife, war sites, picturesque scenery, and open space, Cheorwon County is currently being promoted as a tourist destination (Fig. 6.8)(Kim et al., 2016).

6.2. Field Methods

6.2.1. Cheorwon County: Day 1 – January 6, 2020

Following a 3:00 PM arrival in Yangji Gil Village, a brief visit 30-minute visit was made to the southwest corner of Tokyo Reservoir and the rice paddies and greenhouse area directly below the reservoir dam from 3:30 PM to 4:00 PM. Here, a few walking bird observations were made using

Table 6.1. Locations of notable features of the Cheorwon Basin.

Feature	Korean Name	Latitude	Longitude
Yangji Gil Village,	양지길	38°16'06.21"N	127°17'02.40"E
Tokyo Reservoir	토교저수지	38°16'45.25"N	127°17'26.70"E
Hantang River Bird Watching Hide	한탄강 - 조류 관찰 숨기기	38°16'30.58"N	127°18'48.45"E
DMZ Crane Peace Town Visitor Center	DMZ 두루미평화타운	38°16'0.54"N	127°16'54.76"E
Ice Cream Hill (formerly Sabseulbong)	아이스크림고지	38°17'9.00"N	127°14'16.00"E
Dongsong Reservoir	동송저수지	38°18'10.31"N	127°14'46.82"E
Woljeong Ri Train Depot	월정리역	38°18'33.04"N	127°13'46.04"E
Sanmyeong Lake	산명호	38°17'6.57"N	127°10'52.33"E
Hantang River Crane Site	한탄강	38°12'10.59"N	127°16'17.41"E

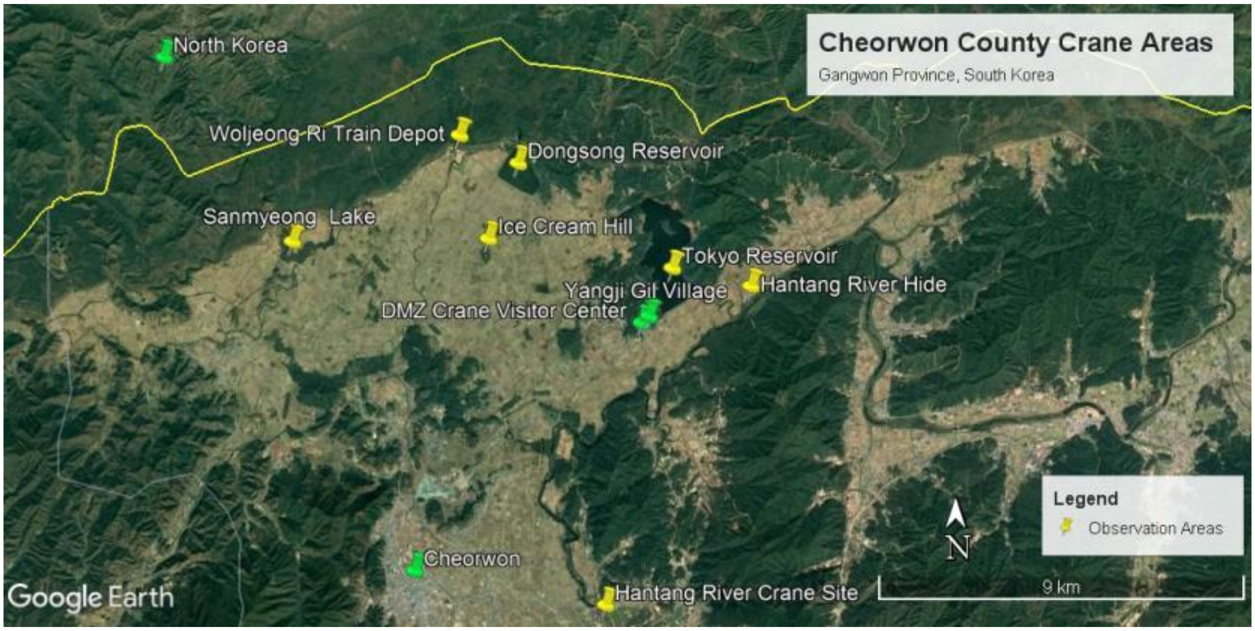

Figure 6.2. Overview of Cheorwon County crane areas, Cheorwon County, Gangwon Province, South Korea.

binoculars. Fixed point observations were made from 4:15 PM to 5:40 PM at the Hangtang River bird hide, located about 2.5 km east of Yangji Gil.

6.2.2. Cheorwon County: Day 2 – January 7, 2020

Brief morning observations were made at the southwest corner of Tokyo Reservoir from 8:00 AM to 8:30 AM before traveling to Yeoncheon County to visit crane areas on the Imjin River (see Section 5, above). Upon returning to Yangji Gil Village after lunch, moving, though not systematic, observations of cranes were made from 2:15 PM to 4:30 PM. This involved driving a circuit around Ice Cream Hill on farm roads through rice paddies from Yangji Gil Village to the Woljeong Ri Train Depot as a steady rain fell.

6.2.3. Cheorwon County: Day 3 – January 8, 2020

Brief morning observations were made at the southwest corner of Tokyo Reservoir and in the rice paddy and greenhouse areas directly below the reservoir dam from 7:40 AM to 8:40 AM.

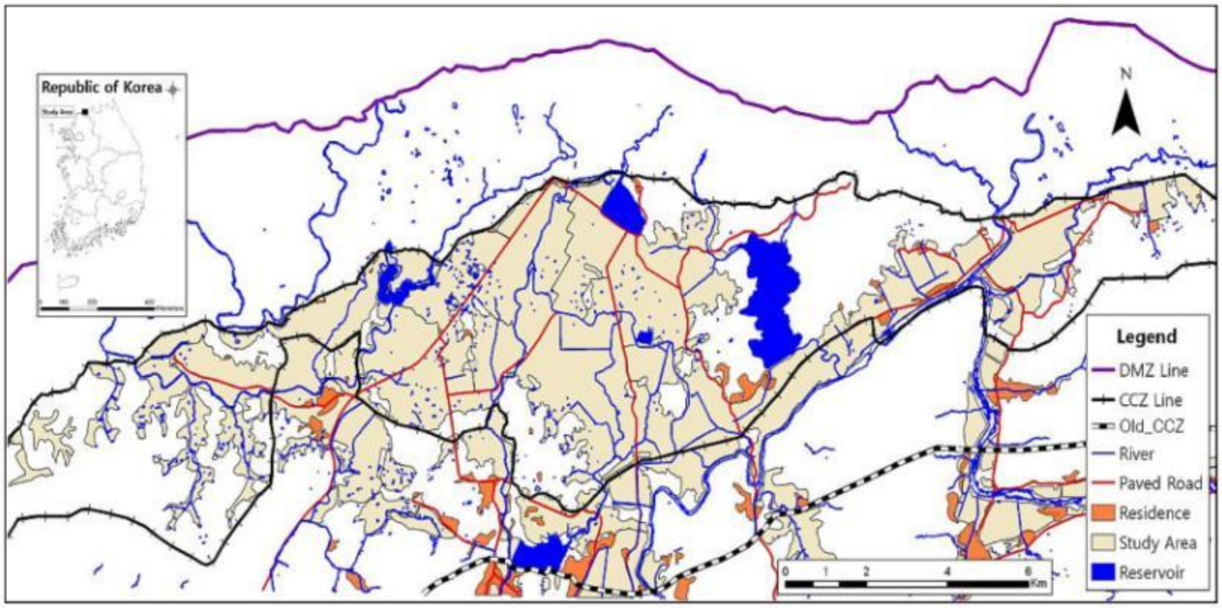

Figure 6.3. Map showing the 2011 boundaries of the Demilitarized Zone (DMZ) and the Civilian Control Zone (CCZ), as well as the earlier boundaries of the CCZ, where economic activities beyond agriculture are largely restricted. Source: Yoo et al., 2011.

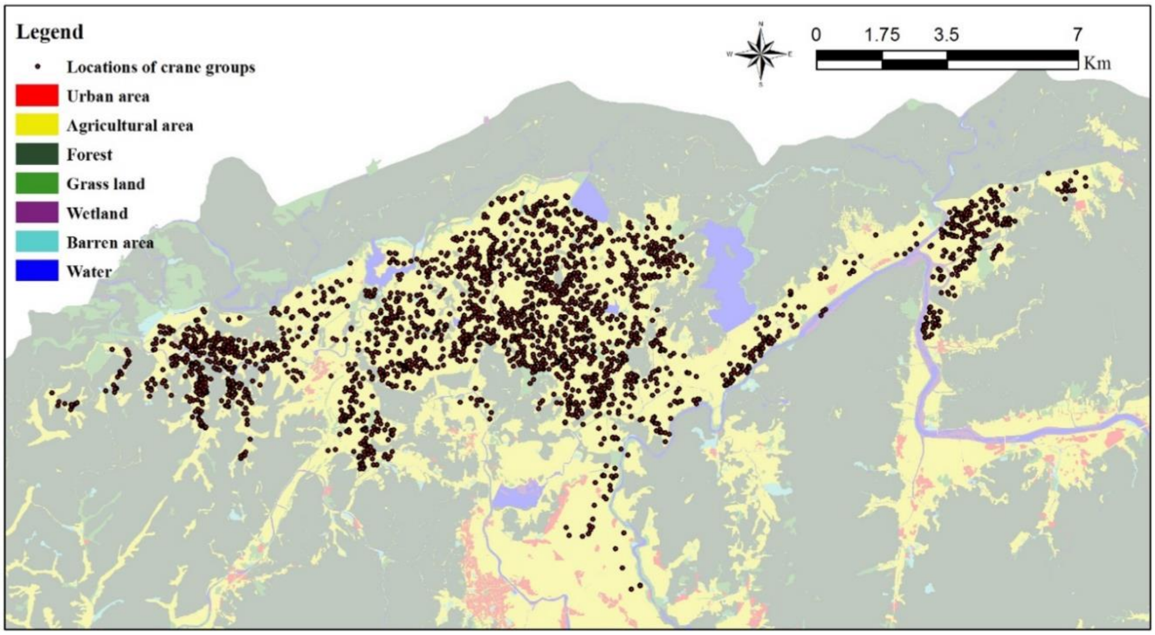

Figure 6.4. Location of red-crowned crane groups observed in Cheorwon County from October 2009 to March 2010. Source: Kim et al., 2016.

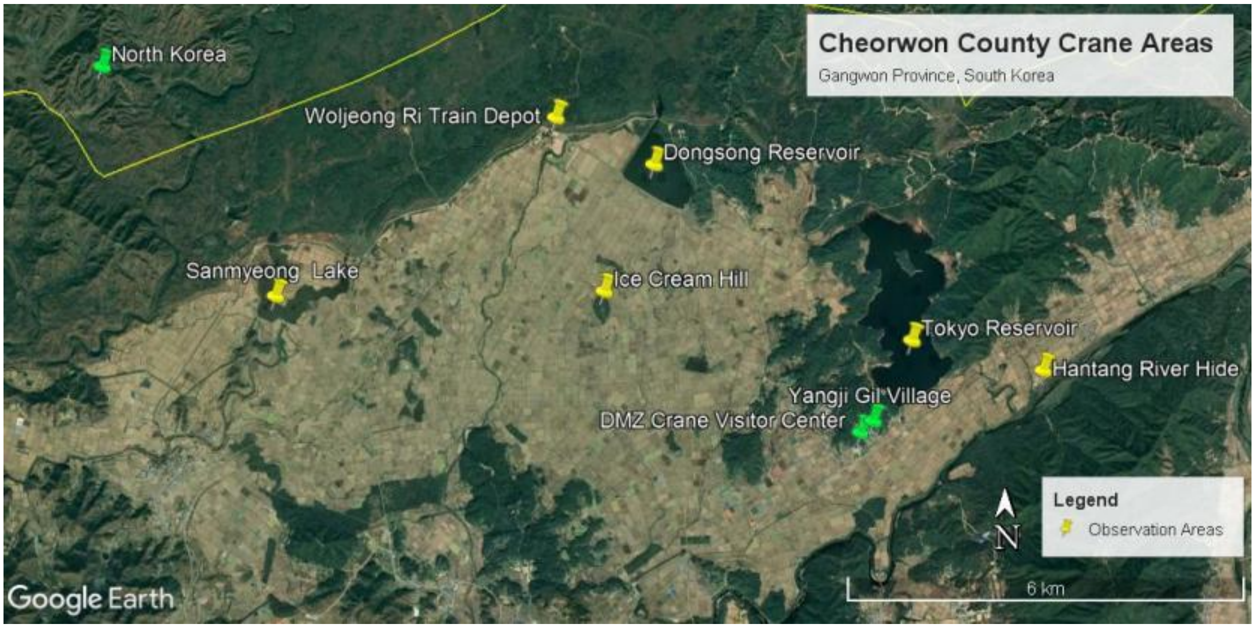

Figure 6.5. Cheorwon County crane areas visited on January 6-8 and 12, 2020, Cheorwon County, Gangwon Province, South Korea.

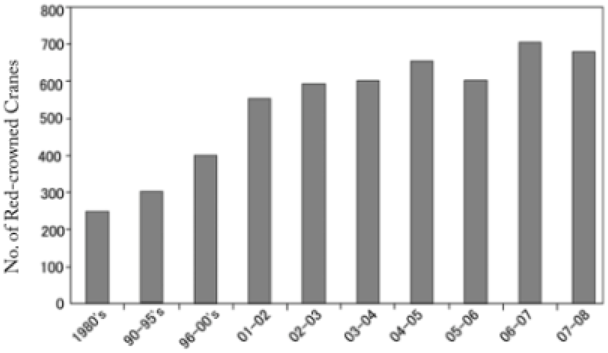

Figure 6.6. Winter red-crowned crane population estimates in Cheorwon County, 1980s-2008. Source: Lee, 2009.

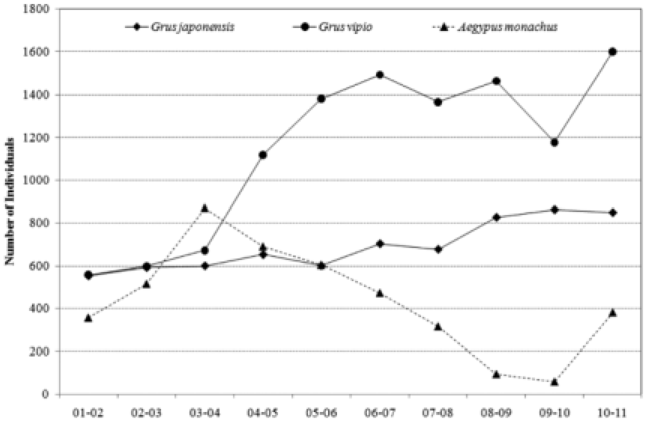

Figure 6.7. Winter red-crowned crane *Grus japonensis*, white-naped crane *Grus vipio*, and cinereous vulture *Aegypius monachus* counts at Cheorwon, 2001-2011. Source: Yoo et al, 2011.

Table 6.2. Winter red crowned and white-naped crane counts in Cheorwon County, South Korea, from the 1980s to 2011 and 2020.

Period	Red-crowned Crane High Count*	White-naped Crane High Count*	Source
1980s	250*	ー	Lee, 2009
1990-1995	300*	ー	Lee, 2009
1996-2000	400*	ー	Lee, 2009
2001-2002	550	520*	Lee, 2009; Yoo et al., 2011
2002-2003	590*	600*	Lee, 2009; Yoo et al., 2011
2003-2004	600	675*	Lee, 2009; Yoo et al., 2011
2004-2005	650*	1120*	Yoo et al., 2011
2005-2006	676	1380*	Lee, 2009; Yoo et al., 2011
2006-2007	704	1490*	Lee, 2009; Yoo et al., 2011
2007-2008	678	1360*	Lee, 2009; Yoo et al., 2011
2008-2009	825*	1465*	Yoo et al., 2011
2009-2010	863	1175*	Kim et al., 2016; Yoo et al., 2011
2010-2011	845*	1595*	Yoo et al., 2011
January 18, 2020	1179	4573	NIBR, unpublished data

*Note: Figure presented is an estimate made from Figure 6.6 or Figure 6.7 and is not an exact count.

6.2.4. Cheorwon County: Day 4 – January 12, 2020

Observations made on this day were part of the formal monthly winter crane count of the Cheorwon Basin organized by the Waterbird Network Korea and the DMZ Crane Committee. This involved a coordinated count by 12 monitoring groups simultaneously counting cranes on assigned survey blocks covering a 10,000 ha area of crane habitat in the Cheorwon Basin. The survey was conducted over a designated two-hour period from 10:00 AM to 12:00 PM. Participants first attended a briefing meeting where they received maps of their assigned survey blocks and rules were explained on how to count groups of cranes that fly off while being counted. Then, traveling in groups of 2 to 4 observers, crane counts were made using binoculars and spotting scopes from cars circling assigned rice paddies. Counts were made while both moving, for small crane groups, and parked, for counting larger crane groups. Crane locations and counts were noted on maps of the respective survey blocks. Because of poor sight lines resulting from rice paddy terracing and tree and shrub patches, fixed point counts alone were not a feasible option for this type of rapid survey. Following completion of the two-hour morning survey, the survey supervisor from the Waterbird Network Korea spent the afternoon conducting spot checks of crane counts in survey blocks in the main survey area between the Tokyo and Sanmyeong Reservoirs.

6.3. Results

Results of crane counts made during the January 2020 visits to Cheorwon County are summarized in Table 6.3, below.

6.3.1. Cheorwon County: Day 1 – January 6, 2020

Only five white-naped cranes were observed below the Tokyo Reservoir dam on the edge of Yangji Gil Village on the afternoon of January 6th. However, the Hangtang River bird hide provided an opportunity to watch cranes feeding in a river setting at fairly close range, with 26

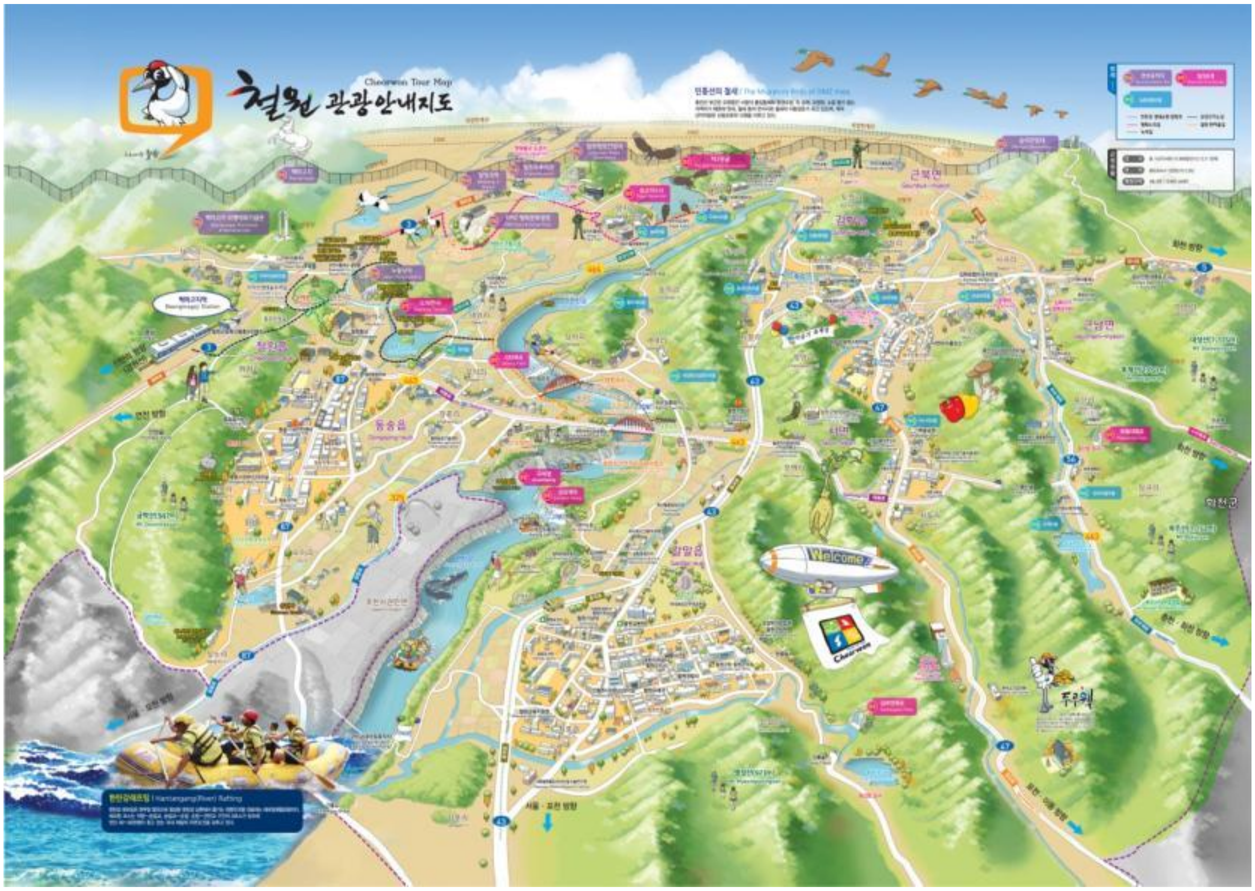

Figure 6.8. Cheorwon County tourism promotion map indicating crane and birdwatching areas along the DMZ. Source: Cheorwon, 2019.

red-crowned cranes and two white-naped cranes present on the ground there while an additional four white-naped cranes were seen in flight. The location also had good duck viewing, including Baikal teal, northern pintail, eastern spot-billed duck, a lone Eurasian wigeon (*Anas penelope*) and perhaps 200 mallards. In addition, a white-tailed eagle was sighted flying upriver past the hide.

6.3.2. Cheorwon County: Day 2 – January 7, 2020

No cranes were seen in the vicinity of Tokyo Reservoir on the morning of January 7th. However, the real avian spectacle observed at the Tokyo Reservoir was the thousands of greater white-fronted geese that spend the night in a large raft on the reservoir and then fly out to the fields in large noisy flocks after sunrise. On this particular morning, a lone snow goose (*Anser caerulescens*) was also sighted. The afternoon circuit of Ice Cream Hill in the rain on January 7th yielded a cursory count of 172 red-crowned and 408 white-naped cranes. These were seen in a mix of family groups and large flocks of up to 138, in the case of white-naped cranes, and up to 30 for red-crowned cranes. Flocks of both species were frequently seen mixed together.

6.3.3. Cheorwon County: Day 1 – January 8, 2020

The hour of morning observations on January 8th at the Tokyo Reservoir Dam yielded counts of eight red-crowned and 26 white-naped cranes that were flying out from their night roosts in the

Table 6.3. Red-crowned and white-naped crane counts in the Cheorwon Basin, Cheorwon County, January 6-8,12, 18, 2020.

Date	Observation Location	Location (Korean)	Latitude	Longitude	Red-crowned Crane Count	White-naped Crane Count
January 6, 2020	Tokyo Reservoir/ Yangji Gil Village	토교저수지/양지길	38°16'19.56"N	127°17'21.76"E	0	5
January 6, 2020	Hangtang River Bird Hide	한탄강 - 조류 관찰 숨기기	38°16'30.58"N	127°18'48.45"E	26	6
January 7, 2020	Tokyo Reservoir/ Yangji Gil Village	토교저수지/양지길	38°16'19.56"N	127°17'21.76"E	0	0
January 7, 2020	Ice Cream Hill Circuit from Yangji Gil Village to the Woljeong Ri Train Depot	아이스크림고지	38°17'9.00"	127°14'16.00"E	172	408
January 8, 2020	Tokyo Reservoir/ Yangji Gil Village	토교저수지-양지길	38°16'19.56"N	127°17'21.76"E	8	26
January 12, 2020*	Waterbird Network Korea/ DMZ Crane Committee Cheorwon County Survey	철원군	38°17'9.00"	127°14'16.00"E	1232	4444
January 18, 2020**	NIBR Cheorwon County Survey	철원군	38°17'9.00"	127°14'16.00"E	1179	4573

Sources: *Kisup Lee, personal communication, 4 July 2022; **NIBR, unpublished data.

reservoir to the surrounding agricultural feeds for a day of feeding. Also observed again were thousands of greater white-fronted geese making their morning flight from the reservoir to the local stubble fields.

6.3.4. Cheorwon County: Day 4 – January 12, 2020

Total crane counts for the full Waterbird Network Korea/DMZ Crane Committee survey on January 12, 2020 were as follows: 4444 white-naped cranes, 1232 red-crowned cranes; 5 hooded cranes, 3 common cranes, and 3 sandhill cranes (Kisup Lee, personal communication, 4 July 2022). These counts corresponded closely to subsequent NIBR counts at Cheorwon on January 18, 2020 of 4573 white-naped cranes, 1179 red-crowned cranes; 5 hooded cranes, 2 common cranes, and 3 sandhill cranes (NIBR, unpublished data). Over the course of the entire winter of 2019-2020, systematic Cheorwon-wide crane surveys performed by the Waterbird Network Korea and the DMZ Crane Committee yielded peak counts of 1232 red-crowned cranes and 5631 white-naped cranes (EAAFP, 2020). On the evening of January 12th, we also observed the daily return of thousands of wild geese coming back from the fields to their night roost in Tokyo Reservoir, appearing in wave after wave of noisy “V” formations.

6.4. Discussion

As in Yeoncheon, crane numbers in Cheorwon County have risen dramatically since systematic crane counts first began in the early 2000s. During this time, red-crowned cranes numbers have experienced a twofold increase since 2002 while white-naped crane numbers have increased ninefold over the same period (Figs. 6.6 and 6.7, Table 6.2). These increases have occurred even as economic development in Cheorwon has accelerated and the size of the CCZ along the border with North Korea has been reduced (Lee, 2009).

Perhaps the largest threat to the long-term viability of Cheorwon County as a suitable crane wintering ground has been the intensification of commercial farming in the region. This first began in the late 1990s with reclamation work to level rice paddy terraces and line streams and irrigation canals bordering paddy fields with concrete (Lee, 2009; Yoo et al., 2015). This eliminated many small wetlands and riparian corridors favored by cranes for feeding on wild plant and animal foods (Lee, 2009). A second issue has been the autumn plowing of rice paddies to accelerate decomposition of rice stubble and straw, which buries fallen grain that cranes depend on for food in winter. In December 2002, 37 percent of rice paddies in Cheorwon underwent autumn plowing (Lee, 2009). Another issue has been the collection of rice straw to be placed in plastic covered silage bails, which eliminates both a food source, rice-bearing straw, and feeding areas that are covered by these silage bails (Lee, 2009). Lee (2009) also noted that the winter spraying of livestock manure on rice fields results in the loss of waste grain and causes plant roots to decay, further reducing food available to cranes.

More recently, Yoo et al. (2015) noted that soon after a further reduction in the area of the CCZ occurred in 2011, the number and size of greenhouses in newly opened areas of the former CCZ rapidly increased. These greenhouses are used for growing vegetables and flowers and eliminate large tracts of rice paddy habitat used by cranes in winter, such as in the vicinity of Yangji Gil Village (Austin, 2019). Accompanying these greenhouses are an increased number of powerlines that, as at Yeoncheon, constitute a severe flight hazard for slow maneuvering cranes landing on neighboring rice paddies (Momose and Momose, 2019). Notably, in 2013, the Republic of Korea’s Ministry of National Defense removed a further 504 ha of land from the CCZ near Yangji and removal of more land from the CCZ is expected (Picon, 2019).

Another form of agriculture that has grown rapidly in recent years in Cheorwon is ginseng cultivation, which is grown on fields covered in canopies (Yoon et al., 2019). Again, as in Yeoncheon, these covered ginseng fields eliminate large areas of important crane habitat in Cheorwon (Mirande et al., 2019). The opening up of the CCZ is also leading to growth in the tourism industry in Cheorwon that has a large potential to cause disturbance to cranes. This includes disturbance from construction of tourist infrastructure, such as public parks and paved roads as well as from tourists, photographers, and birdwatchers approaching cranes too closely, causing them to fly away and expend hard-earned energy (Kim et al., 2016; Picon, 2019; Mirande et al., 2019).

Finally, one large existential threat to Cheorwon as a globally critical crane wintering area is that the basin is not formally protected, since all land in the CCZ is privately owned farmland (Lee, 2009). At present, the primary reason this area of Cheorwon attracts so many cranes is because of the relative absence of human disturbance in the area due to restricted entry stemming from the unresolved Korean conflict. Should this conflict be resolved in the near term, the CCZ could very well be thrown open to economic development (Mirande et al., 2019). Thus, without a concerted government effort to protect this area, most likely as a multiple use nature reserve, the area’s value as crane habitat could quickly be lost in the event of peace coming to the Korean Peninsula.

The reasons why winter crane numbers at Cheorwon continue to increase, in spite of the growing threats to their habitat there, closely parallel those at Yeoncheon. These include: 1) a decline of agriculture in North Korea and the likely consequent degradation of crane habitat there (Lee, 2009); 2) a decline in the annual snow cover period at Cheorwon as a result of global warming that allows migrating white-naped cranes to stay in Cheorwon rather than continuing on to Izumi, Japan (Kisup Lee, personal communication, January 2020); 3) work with farmers to improve paddy field habitat management for the benefit of cranes, including leaving rice straw on fields after harvest, patrolling crane areas to prevent disturbance to cranes, as well as artificial feeding of cranes (EAAFP, 2020); and 4) a possible shift of white-naped cranes from their eastern to western flyway due to an increasing frequency of drought on their breeding grounds in eastern Mongolia (Fig. 5.8)(Mirande et al., 2019; Momose and Momose, 2019).

7. Izumi Wetlands

Kagoshima Prefecture, Japan

Dates Visited: January 15-16 and 18, 2020

7.1. Site Description and Background

The Izumi Wetlands (出水湿地, 32°06'09.21"N, 130°16'30.98"E) are located on the Yatsushiro Sea in Kagoshima Prefecture, about 60 km north of Kagoshima City on the southwest coast of Kyushu, Japan (Fig. 1.1, 7.3, 7.4, and 7.5, Table 7.1). The main crane site consists of a roughly 3.5 km long by 1.5 km wide swath of rice paddies reclaimed from the sea (Figs. 7.3 and 7.4) (Wikipedia, 2020c). This area is divided down the middle by the Iwashita River and both sections are protected from the sea by substantial concrete sea dikes. The site is the single most important wintering ground for hooded cranes, where about 80 percent of the global population spends the winter, which in December 2019 amounted to 13,501 individuals (Figs. 7.2 and 7.7, Table 7.2)(Mirande and Ilyashenko, 2019b). Izumi is also the second most important wintering ground for white-naped cranes after Cheorwon County in South Korea, with an estimated high count of 3500 individuals, in the winter of 2013-2014 (Fig. 7.1)(Haraguchi, 2014). However, this total had declined to a peak January count of 2688 individuals in 2020 as more white-naped cranes overwinter in Cheorwon (Tables 1.1, 1.2, 6.2, 7.2). This shift is possibly due to a decline in the annual snow cover period at Cheorwon that no longer makes it necessary for these cranes to continue on the long migration to Izumi (see Section 6, above).

Historically, cranes in the Izumi area were nearly extirpated by the end of the 19th Century, in large part due to hunting (Wikipedia, 2020c). However, with improved protection to preserve cranes as a sightseeing attraction, crane numbers at Izumi began to rebound rapidly in the 1920s only to crash again during World War II when a navy air base was operational on the Izumi plain (Fig. 7.6, Table 7.2)(Wikipedia, 2020c; Ohsako, 1987). Recognizing Izumi's importance for cranes, on March 29, 1952, the 245 ha Cranes in Kagoshima Prefecture and Their Wintering Place Special Natural Monument was declared (Wikipedia, 2020c). Crane numbers remained stable throughout the 1950s at about 250-300 individuals. However, crane numbers began to rise rapidly in the 1960s with the launch of a government sponsored artificial feeding campaign in the autumn of 1962 that involved setting out an estimated 13,410 kg of wheat over the course of the winter (Ohsako, 1987). Today, over 15,000 cranes spend the winter in Izumi, benefiting from 1500 kg of grain (primarily wheat *Triticum aestivum*) spread daily during the peak crane period (Table 1.1)(Mirande et al., 2019). This is done from the back of trucks moving along closed roads in the core zone of the crane sanctuary. On average, each crane receives about 100 g of grain per day, roughly 10 percent of their daily nutritional needs (Yuko Haraguchi, personal communication, 16 January 2020). The feeding of 15,000 cranes on winter mornings in Izumi is one of the great avian spectacles of East Asia (Fig. 7.2).

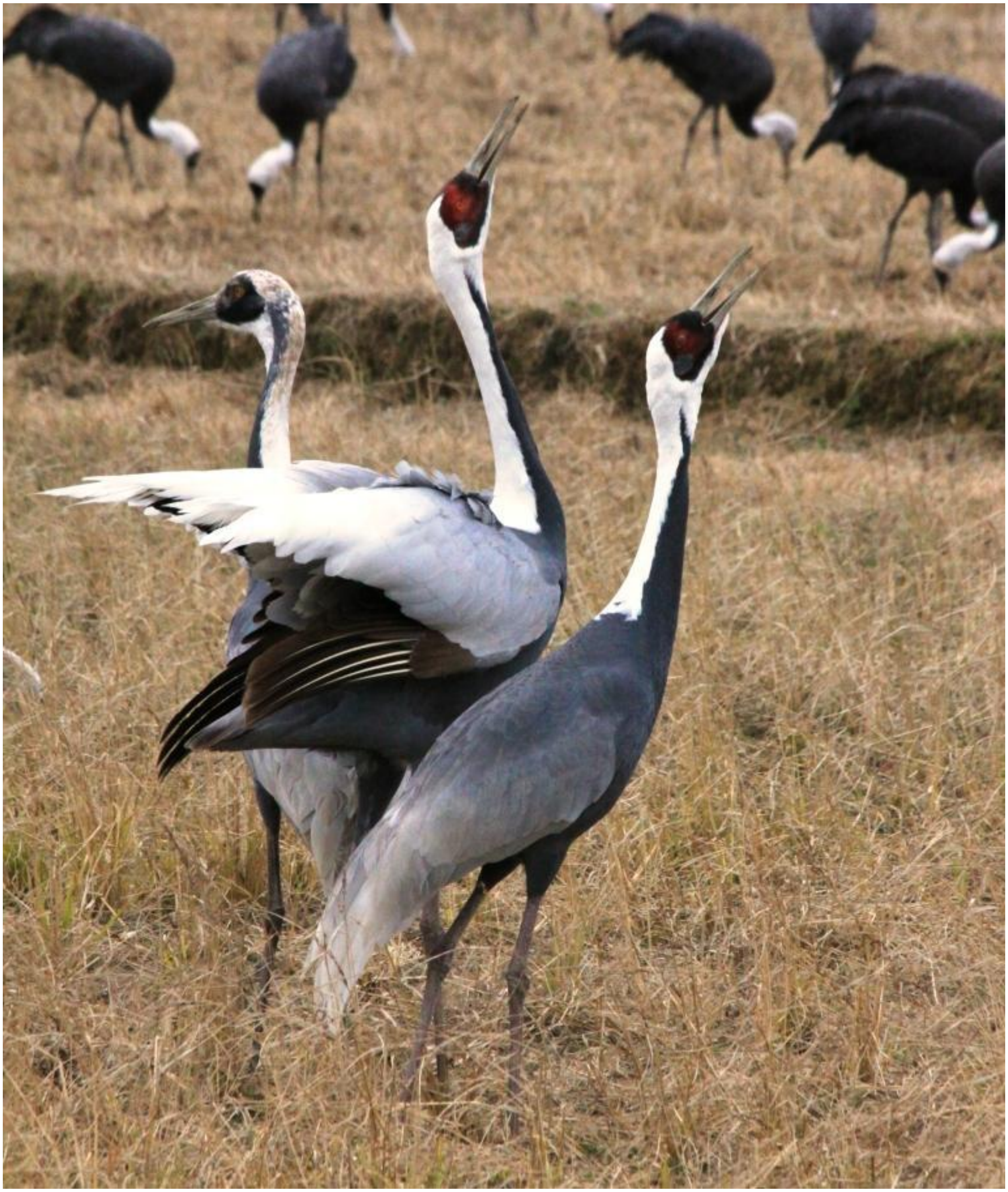

Figure 7.1. White-naped crane *Grus vipio* family with hooded cranes near the Izumi Crane Observation Center, Izumi, Kagoshima Prefecture, Japan.

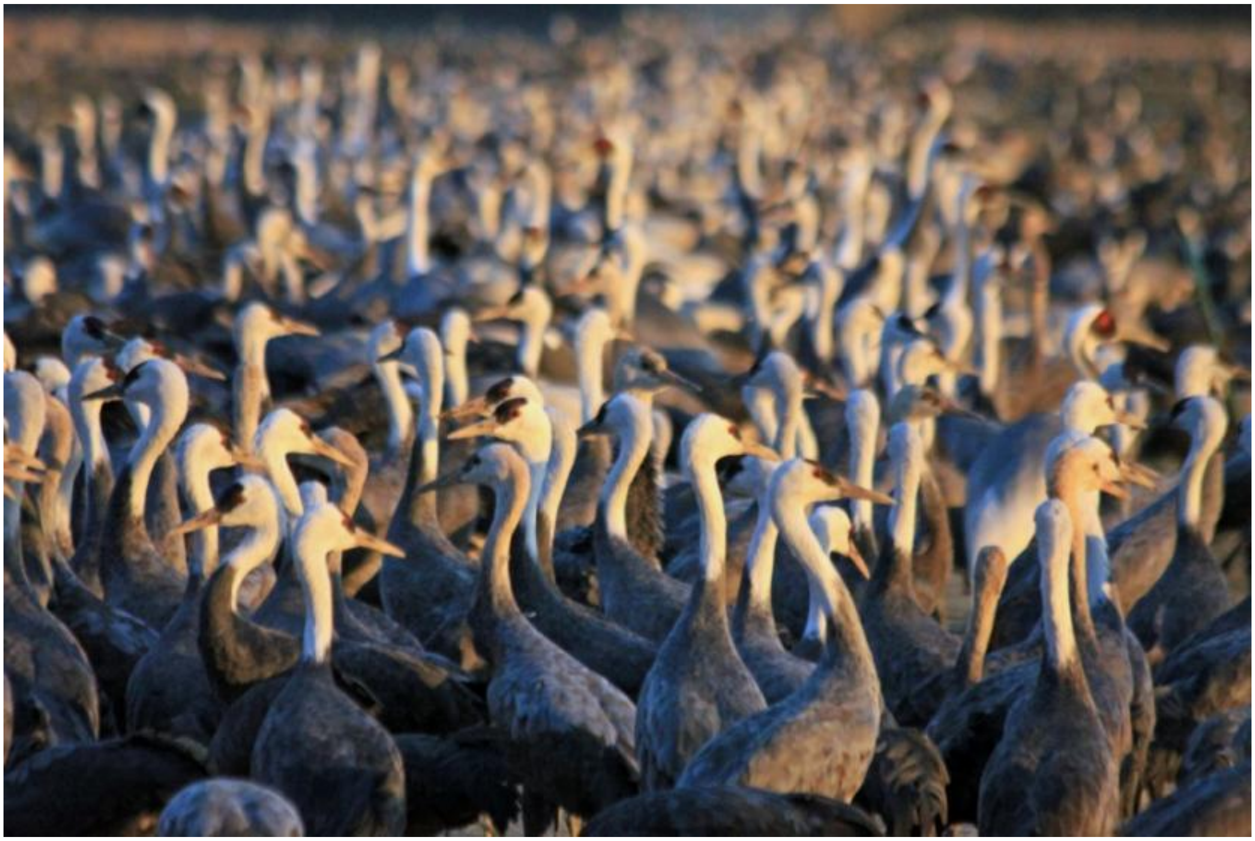

Figure 7.2. Hooded cranes *Grus monacha* at an artificial feeding site near the Izumi Crane Observation Center, Izumi, Kagoshima Prefecture, Japan.

Table 7.1. Main crane and waterfowl areas in Izumi.

Observation Location	Location (Japanese)	Latitude	Longitude
Izumi Crane Museum and Crane Park Izumi	クレインパークいずみ	32° 5'53.44"N	130°20'35.76"E
Komenotsu River	米ノ津川	32° 5'30.89"N	130°20'47.88"E
Izumi Crane Observation Center	出水市ツル観察センタ	32° 6'9.21"N	130°16'30.98"E
Iwashita River	岩下川	32°5'45.53"N	130°16'37.96"E
Cranes in Kagoshima Prefecture and Their Wintering Place Special Natural Monument	鹿児島県のツルおよびその渡来地	32° 6'9.21"N	130°16'30.98"E

The Izumi Wetlands have two artificial roosting sites occupied at night by both cranes and thousands of ducks, one in the west section and one in the east section (Figs. 7.3 and 7.4). These roosting sites lie in sanctuary core zones closed to the public that extend from roughly the middle of the crane feeding grounds north to the sea dike in each of the two sanctuary sections. There is also an excellent visitor center on the site funded by the Izumi City government, the Izumi Crane Observation Center. This center has exhibits on cranes and other bird life in the area as well as a rooftop observation deck overlooking the west section of the natural monument. A hill about one kilometer to the southwest of the observation center provides sweeping views over the site.

The Izumi Crane Observation Center Ebird Hot Spot list had a total of 204 bird species recorded at the site as of February 20, 2020 (Ebird, 2020a). Some other notable bird species sighted in-

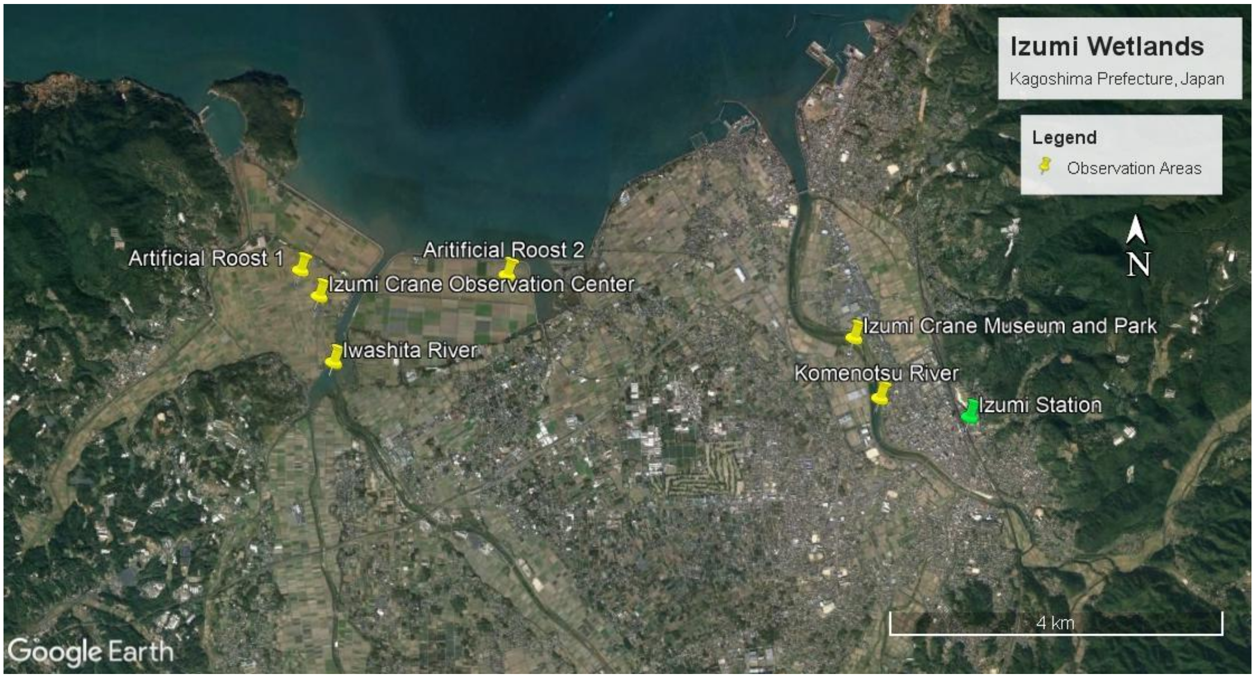

Figure 7.3. Overview of crane areas in the Izumi Basin, Izumi, Kagoshima Prefecture, Japan.

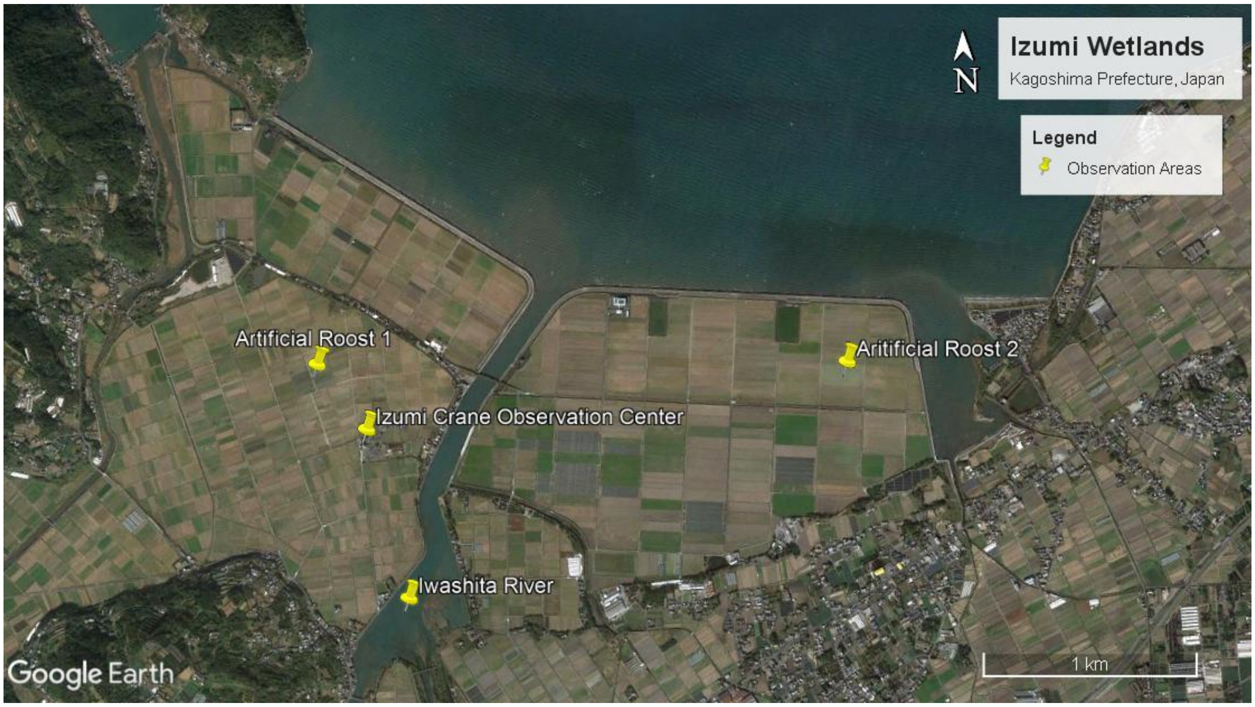

Figure 7.4. Izumi Crane Observation Center, natural monument, and main Izumi crane wintering grounds, located about 7.5 km west of Izumi Station, Kagoshima Prefecture, Japan.

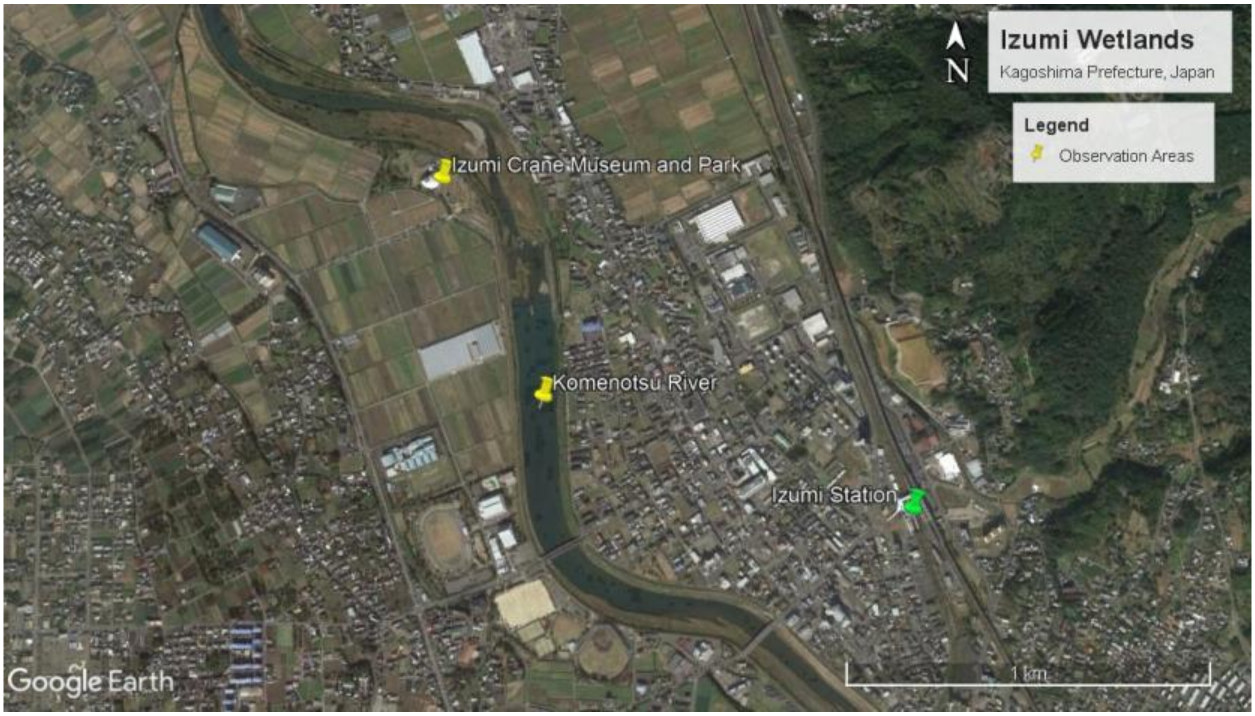

Figure 7.5. Location of the Izumi Crane Museum and Park and the Komenotsu River near Izumi Station, Kagoshima Prefecture, Japan.

clude thousands of northern pintails, Eurasian wigeons, and mallards that overwinter in Izumi, the three most common duck species in the area, as well as small numbers of common, sandhill, and demoiselle cranes (*Grus virgo*)(Yuko Haraguchi, personal communication, 16 January 2020). Small numbers of both Eurasian and black-faced spoonbills winter at the site, as do common shelduck, common teal (*Anas crecca*), greater scaup (*Aythya marila*), peregrine falcon (*Falco peregrinus*), and osprey (*Pandion haliatus*). In addition to the main natural monument area around the crane observation center, smaller numbers of cranes and waterfowl can be found in the fields around the Izumi Crane Museum, located about 1.6 km northwest of the Izumi train station on the west bank of the Komenotsu River (Figs. 7.3 and 7.5, Table 7.1). The Komenotsu River in central Izumi also has good waterfowl viewing, including falcated duck (*Anas falcata*, NT), common coot (*Fulica atra*), eastern spot-billed duck, gadwall (*Anas strepera*) and more.

7.2. Field Methods

7.2.1. Izumi: Day 1 – Komenotsu River and Izumi Crane Park – January 15, 2020

The Izumi Crane Park was visited on the afternoon of January 15, 2020. Walking counts were made of waterbirds along the Komenotsu River dike between the Highway 372 bridge, located about a kilometer directly east of Izumi Station, and the crane park as well as of cranes at the crane park itself (Figs. 7.3 and 7.5).

7.2.2. Izumi: Days 2 and 3 – Crane Observation Center and fields – January 16 and 18, 2020

The main Izumi crane wetlands in the vicinity of the Izumi Crane Observation Center were visited on January 16, 2020 from 10:05 AM to 3:30 PM and on January 18, 2020 from 6:30 AM

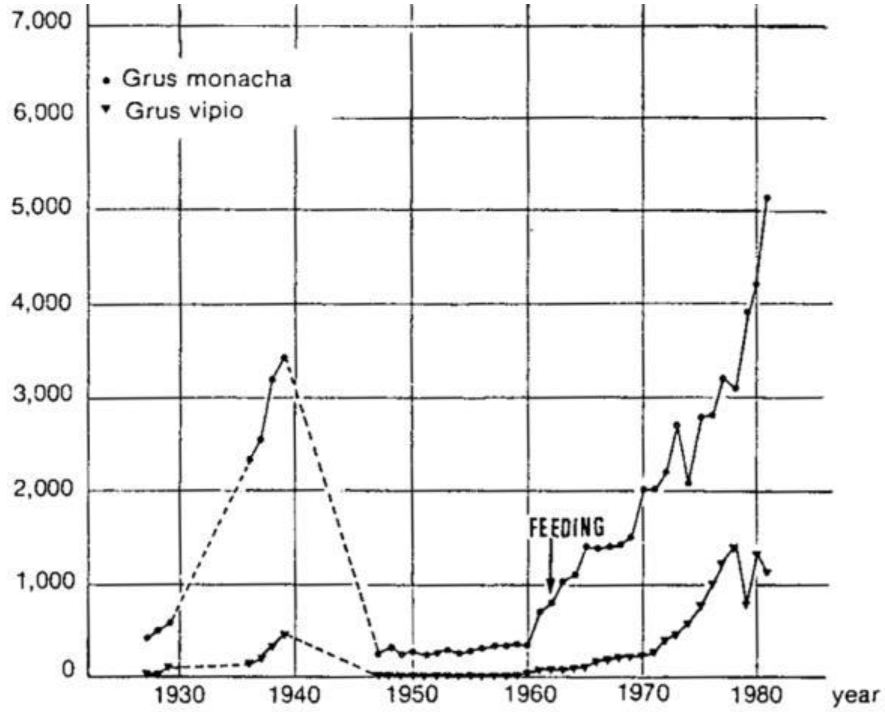

Figure 7.6. Annual hooded crane (*Grus monacha*) and white-naped crane (*Grus vipio*) counts at Izumi and Akune, Kagoshima Prefecture, Japan, 1927-1981. Source: Ohsako, 1987.

to 3:30 PM (Figs. 7.3 and 7.4). At this time, no formal count of cranes was made since a full crane count had been conducted by the Kagoshima Crane Conservancy and local students on December 21, 2019 (Table 1.1). This systematic count was performed using spotting scopes and binoculars for fixed point counts along the roads and sea dikes in the main crane area as well as from the roof of the crane observation center. However, the author did take notes on cranes and other birds present during the course of walking observations made on January 16th and 18th.

7.3 Results

7.3.1. Izumi: Day 1 – Komenotsu River and Izumi Crane Park – January 15, 2020

No cranes were sighted along the 1.5 km long stretch of the Komenotsu River from Izumi Station to the Izumi Crane Museum until reaching the Izumi Crane Park. At the crane park, a group of 40 hooded cranes were observed in the agricultural fields immediately south of the entry driveway for the Izumi Crane Museum complex (Figs. 7.5 and 11.1, Table 7.1). Notable birds seen along the Komenotsu River included a lone osprey flying upriver and 135 falcated ducks (also see Appendix 2).

7.3.2. Izumi: Day 2 – Crane Observation Center and fields – January 16, 2020

In addition to the thousands of hooded cranes and hundreds of white-naped cranes sighted, other crane species observed included five sandhill cranes, a lone common crane, and the only demoiselle crane sighted at all crane sites visited in China, Korea, and Japan. Other notable birds species observed included thousands of northern pintails on artificial roost #1 (Fig.7.4), common

Table 7.2. Crane counts in Izumi 1939-1982 and 2008-2019.

Winter	**Hooded Cranes**	**White-naped Cranes**	**Total Cranes**	**Notes**
1939-1940	3435	467	3902	Source: Ohsako, 1987 (1939-1982 only)
1947-1948	250	25	275	
1961-1962				Year post-war numbers begin to increase
1962-1963			909	Large-scale artificial feeding begins
1963-1964			1149	
1964-1965			1251	
1965-1966			1573	
1966-1967			1654	
1967-1968			1677	
1968-1969			1660	
1969-1970			1798	
1970-1971			2336	
1971-1972			2313	
1972-1973			2689	
1973-1974			3245	
1974-1975			2745	
1975-1976			3649	
1976-1977			3836	
1977-1978			4518	
1978-1979			4631	
1979-1980			4775	
1980-1981			5602	
1981-1982	5227	1015 (calculated)	6246	100 of the hooded cranes were in Akune, also 3 common cranes and 1 demoiselle crane
2008	10,000			Mirande and Ilyashenko, 2019b
2009		3142		Harris and Mirande, 2013
2013	12,000			Mirande and Ilyashenko, 2019b
2013-2014	10,748	3,500	14,260	Haraguchi, 2014; also 5 common, 4 sandhill, 3 hooded-common crane hybrids
2014-2015	13,500			Mirande and Ilyashenko, 2019b
2017-2018	14,000			Mirande and Ilyashenko, 2019b
2019.12.21	13,501	1642	15,155	Source: Kagoshima Crane Conservancy via the Izumi Crane Observation Center. Also 4 common, 7 sandhill, and 1 demoiselle crane
2020.01		2688		Kagoshima Crane Conservancy via Yuko Haraguchi, personal communication, 14 January 2022

shelducks, 15 Eurasian spoonbills, a lone black-faced spoonbill, and a peregrine falcon (ssp. *japonicus*)(also see Appendix 2).

7.3.3. Izumi: Day 3 – Crane Observation Center and fields – January 18, 2020

The highlight of the day's observations was watching the morning feeding of the cranes at sunrise from the roof of the crane observation center. This involved grain being poured from the back of a pickup truck along the farm roads near the two artificial roosts, after which, thousands of cranes flew out of their respective roosting areas to feed. The large morning congregation of thousands of cranes feeding on grain-covered roads made for arguably the most spectacular crane viewing of all Northeast Asia crane sites visited (Fig. 7.2). Other bird species sighted showed little variation from January 16 (see Appendix 2).

7.4. Discussion

With systematic counts of 13,501 hooded cranes and 2688 white-naped cranes made in December 2019 and January 2020, respectively, crane populations at Izumi have increased dramatically since post-war lows of 250 hooded cranes and 25 white-naped cranes were counted in the winter of 1947-1948 (Table 7.2). This rapid rise has resulted from a variety of factors, including 1) declaration of the Izumi crane wintering areas as a special natural monument in 1952, 2) launch of a large-scale artificial feeding campaign for cranes in 1962 that continues to this day (Ohsako, 1987), 3) improved management of crane habitat at Izumi, including maintenance of artificial roosting sites and erection of screens at key locations to reduce disturbance to cranes from tourists and photographers, 4) creation of closed crane protection areas within the special natural monument where only Kagoshima Crane Conservancy staff are permitted to enter, 5) location specific actions, such as putting up colorful streamers around agricultural fields to prevent injury to landing cranes by marking nearly transparent fencing erected to keep cranes out of crops, and 6) abandonment by cranes of other sites in Kyushu that lack artificial feeding or have experienced changes in land use that no longer make them suitable crane habitat.

However, as shown in Table 7.2, white-naped crane counts peaked in the winter of 2013-2014 at about 3500 individuals but have since fallen. This decline is believed to be directly correlated to the dramatic rise in white-naped crane numbers at Cheorwon over the same period (Table 6.2). The reason for this shift is thought to be warming winter temperatures and a sharp drop in the number of annual snow cover days at Cheorwon, which makes it no longer necessary for the eastern white-naped crane population to continue on the second half of their annual winter migration from Cheorwon to Izumi (Fig. 5.8, see Section 6, above).

With respect to hooded cranes at Izumi, there appear to be two distinct morphs, the more common black morph, and a paler grey morph (Fig. 7.7). The grey morph is believed to be becoming increasingly more common than in the past relative to the black morph, although no formal study on the proportion of each has been conducted yet (Yuko Haraguchi, personal communication, 16 January 2020). A few hooded-common crane hybrids also overwinter in Izumi. With respect to other waterfowl species, conspicuously absent were wild geese, of which only a few have stopped over on migration or overwintered in recent years (Yuko Haraguchi, personal communication, 14 January 2022). However, large congregations of tens of thousands of wild geese can be found at wetlands in northern Honshu and southern Hokkaido (e.g. see Shimada et al., 2005; Ikawa and Ikawa, 2013; Shimada et al., 2016).

The largest current threat to cranes at Izumi is now simply the concentration of southern Japan's cranes at a single location in winter, including roughly 80 percent of the global hooded crane population (Mirande and Ilyashenko, 2019b). This puts these crane populations at high risk for experiencing an avian epidemic (Mirande at al., 2019) or for large losses due to increasingly frequent severe and unseasonal weather events that are occurring as a result of climate change, although winter is dry season in Japan. To address the threat of over concentration, research is being conducted on how to entice cranes to occupy other areas of Kyushu that were formerly occupied by cranes (Archibald and Meine, 2019; Yuko Haraguchi, personal communication, 15 January 2020). This high concentration of cranes is also of concern to local poultry farmers, with there being over five million chickens on poultry farms in Izumi that could be wiped out by in-

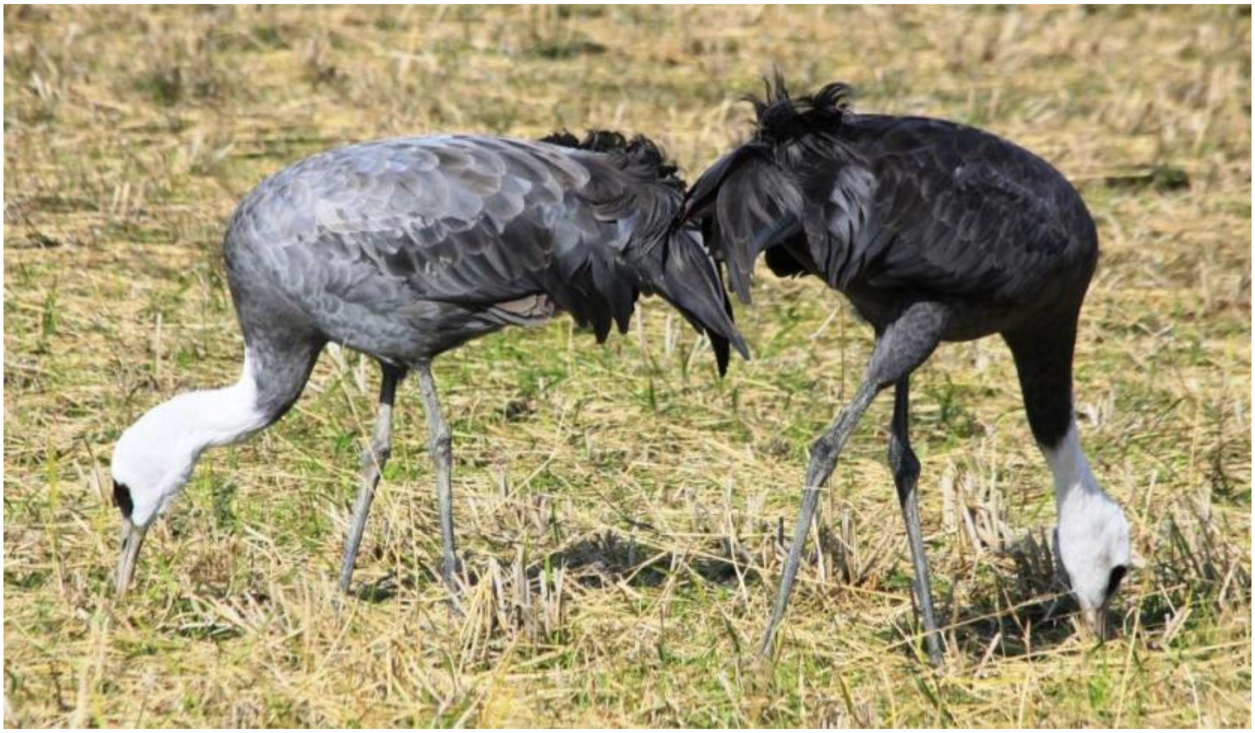

Figure 7.7. Dark and light morph hooded cranes feeding together, Izumi Wetlands, Kagoshima Prefecture, Japan.

troduction of avian influenza brought by cranes or other migratory waterfowl (Hartup and Mirande, 2019).

Beyond crane population density, another threat to cranes is conflict with farmers. Cranes at Izumi feed on local agricultural fields and white-naped cranes in particular are known to aggressively dig through soil berms dividing rice paddies, disrupting irrigation regimes and requiring repairs (Yuko Haraguchi, personal communication 16 January 2020). Cranes also cause damage to vegetables being grown in winter (Mirande et al., 2019). Beyond the confines of the 104 ha Izumi crane sanctuary, crane feeding areas on agricultural fields are also threatened by human disturbance, development of roads, and powerlines (Mirande et al., 2019). These threats could be reduced by rental of additional agricultural fields for the benefit of cranes.

One existential threat to the Izumi site is simply sea level rise resulting from climate change. Reclaimed from the sea, and presently protected by substantial concrete sea dikes, in the long term, rising seas may eventually permanently inundate the entire site. In the short term, a sufficiently large typhoon storm surge could leave the entire site inundated by salt water and of limited use for agriculture. There is also the question of saltwater intrusion into local groundwater supplies that could adversely affect agriculture, although at present this issue is being addressed through freshwater recharge ponds (Yuko Haraguchi, personal communication 16 January 2020).

8. Kushiro Wetlands

Kushiro Subprefecture, Hokkaido Prefecture, Japan

Ramsar Listed: June 17, 1980

Dates Visited: January 25-26, 2020

8.1. Site Description and Background

The Kushiro Wetlands (釧路湿原, 43°06'34.21"N, 144°23'57.64"E) lie immediately north of Kushiro City in Hokkaido Prefecture (Figs. 1.1 and 8.2). The main wetland is located primarily along the lower Kushiro River but also extends up the nearby Akan River to the west as well as up the tributaries of both rivers (Figs. 8.2 and 8.3). The largest undeveloped wetland tract is along the Kushiro River and is roughly 27 km long and 12 km wide at its widest. However, the lower wetland is now crossed by roads and the last reach of the Kushiro River has been channelized through the southern wetland to the sea (Fig. 8.2). The wetland is ecologically significant as Japan's largest marsh with the country's largest tracts of both peatland and reedbeds while other major vegetation types include *Carex* sedges, alders, willows, and peat moss (Ramsar, 1999; Wikipedia, 2020d and e). Three large freshwater lakes occur along the northeast side of the wetland, Takero, Shirarutoro, and Dakobu Lakes (Wikipedia, 2020e). The wetland provides important habitat for critically endangered Sakhalin taimen (*Parahucho perryi*), Japan's largest freshwater fish, as well as for the endangered Blakiston's fish owl (*Bubo blakistoni*), vulnerable Steller's sea eagle (*Haliaeetus pelagicus*), white-tailed eagle, and the marsh's best-known inhabitant, the endangered red-crowned crane (Ramsar, 1999).

Although the Japanese red-crowned crane population is currently restricted to Hokkaido, up until the mid-18th Century, red-crowned cranes were known to winter as far south as central Honshu (Fig. 8.4)(Masatomi, 2008). By the late 19th Century, the red-crowned crane was believed to be extinct in Japan, a victim of both hunting and habitat destruction (Koga, 2008). However, in 1924, about 20 remaining red-crowned cranes were discovered in the Kushiro Wetlands, which led to the first conservation measures being implemented for these cranes, primarily artificial feeding (Masatomi, 2008). Nevertheless, following the end of World War II, the first formal crane survey was conducted in Hokkaido in 1952 which only found 33 cranes (Koga, 2008). This led to intensive artificial winter feeding of cranes, generally with locally grown corn, and improved protection of the Kushiro Wetlands. At an administrative level, crane conservation efforts included: 1) designation of the Kushiro Red-crowned Crane Breeding Area National Natural Monument in 1935, 2) re-designation and expansion of the natural monument in 1979 as the Kushiro Wetland Wildlife Sanctuary, 3) establishment in of the 78.63 km^2 Kushiro-shitsugen Ramsar Site on June 17, 1980 (Fig. 8.5), and finally, 4) establishment of the 268.61 km^2 Kushiro-shitsugen National Park on July 31, 1987 (Fig. 8.6)(Ramsar, 1999; Wikipedia, 2020d and e).

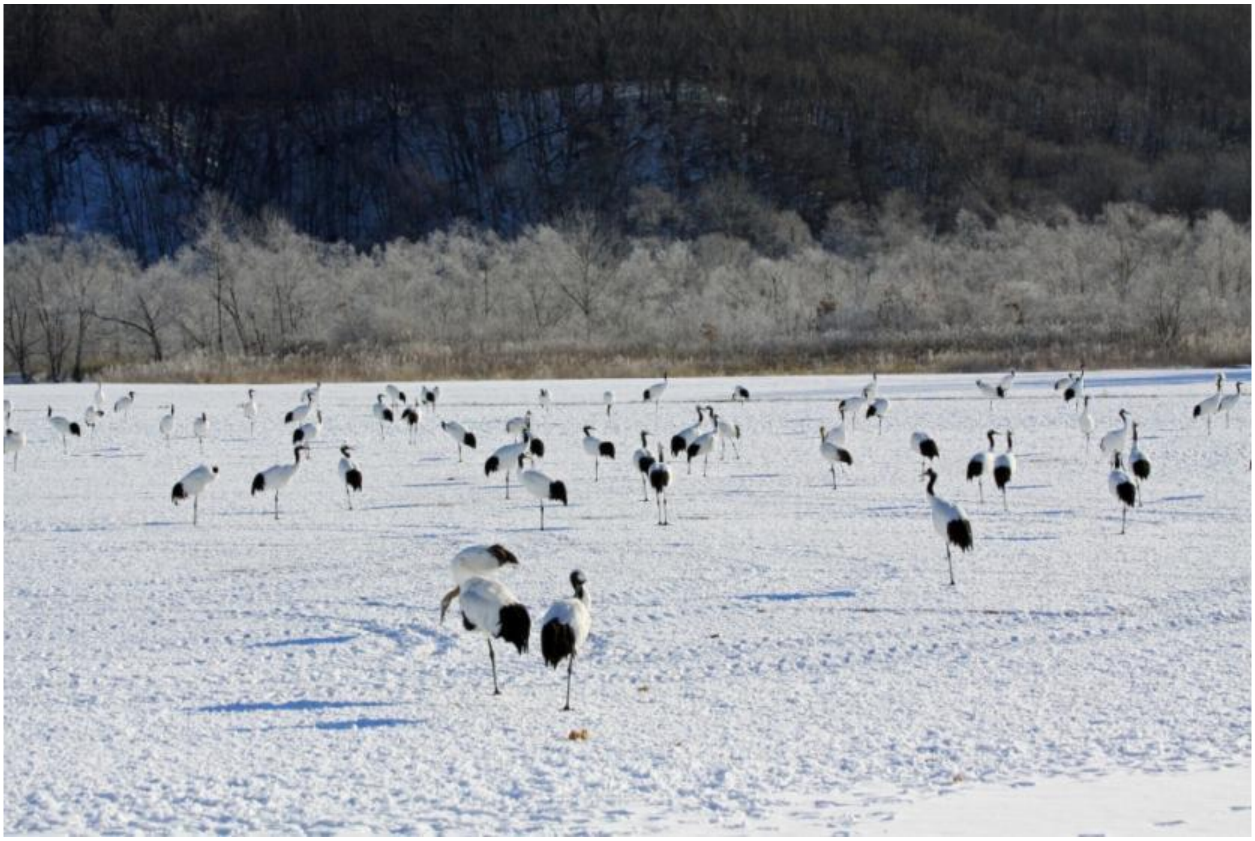

Figure 8.1. Red-crowned cranes *Grus japonensis*, Akan International Crane Center, Kushiro Subprefecture, Hokkaido, Japan.

One result of these efforts has been a steady increase in Hokkaido’s red-crowned crane population since 1952 (Fig. 8.7, Table 8.1). From the 33 cranes found in 1952, the population rapidly increased to just under 200 in 1960, which is partially attributable to improved crane distribution knowledge and survey methods. The population remained relatively stable at that level until 1975, with this leveling-off period being attributed to high mortality of cranes from powerline strikes during the rapid post-war development of Hokkaido at this time (Koga, 2008). Since the mid-1970s, Hokkaido’s crane population has increased steadily, reaching 505 in 1992, breaking the 1000 mark in 2005, and was estimated to be 1400 individuals as of 2013 and 1800 in 2020 (Table 8.1)(Koga, 2008; Masatomi, 2008; Momose and Momose, 2019; TKG, 2020).

Accompanying this population growth has been the dispersal of cranes out of the main Kushiro Marsh area to smaller wetlands and agricultural fields in eastern Hokkaido and beyond. Unlike red-crowned crane populations in mainland Asia, which breed on the wetlands of eastern Siberia, northeast China, and eastern Mongolia and migrate to winter sites in the Korean DMZ and the Jiangsu coast and Yellow River delta in China, Hokkaido’s cranes only make short local seasonal movements and are considered to be non-migratory (Figs. 5.7 and 8.4). While many red-crowned cranes continue to breed in and around the marshes of Kushiro-shitsugen National Park, in winter these cranes congregate on feeding grounds and agricultural fields outside the Kushiro Marsh (Koga, 2009; Momose, 2009).

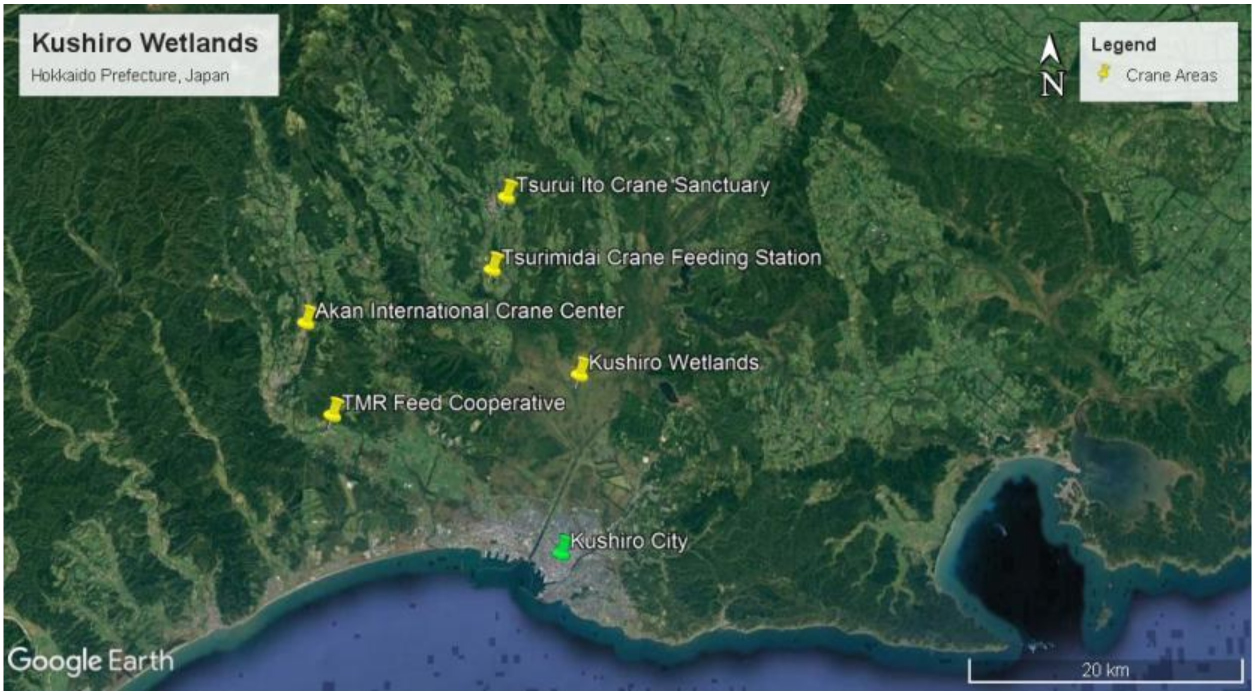
Kushiro Wetlands
Hokkaido Prefecture, Japan
N
Legend
Crane Areas
Tsurui Ito Crane Sanctuary
Tsurimidai Crane Feeding Station
Akan International Crane Center
Kushiro Wetlands
TMR Feed Cooperative
Kushiro City
Google Earth
20 km

Figure 8.2. Overview of the Kushiro Wetlands, Kushiro Subprefecture, Hokkaido, Japan.

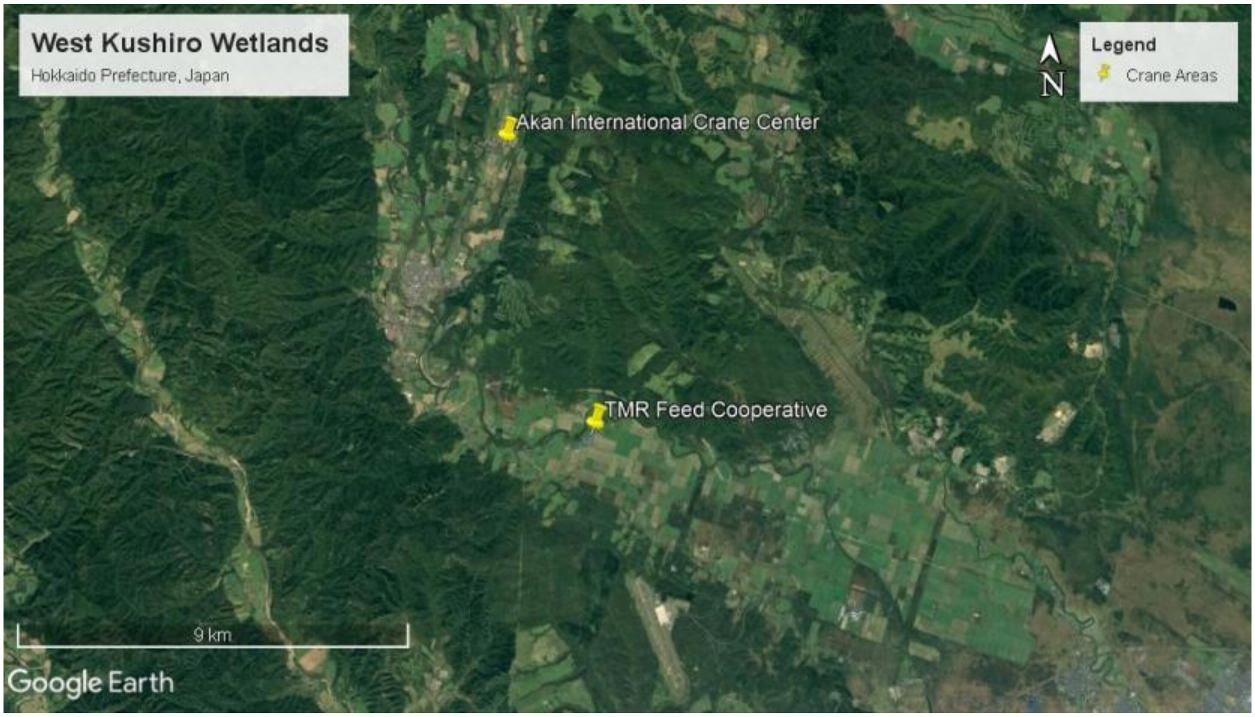

Figure 8.3. Akan International Crane Center and the dairy farming region on the Akan River in the west Kushiro Wetlands.

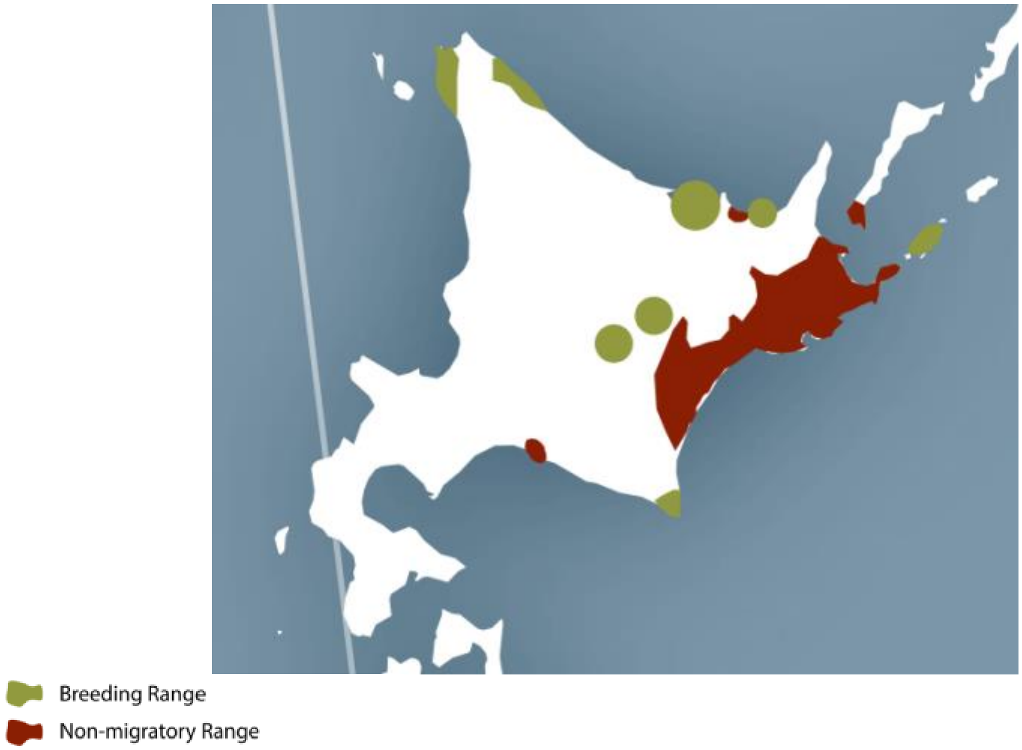

Figure 8.4. Distribution of red-crowned cranes (*Grus japonensis*) in Hokkaido, Japan and neighboring islands. Also see Fig. 5.7. Source: Mirande and Harris, 2019.

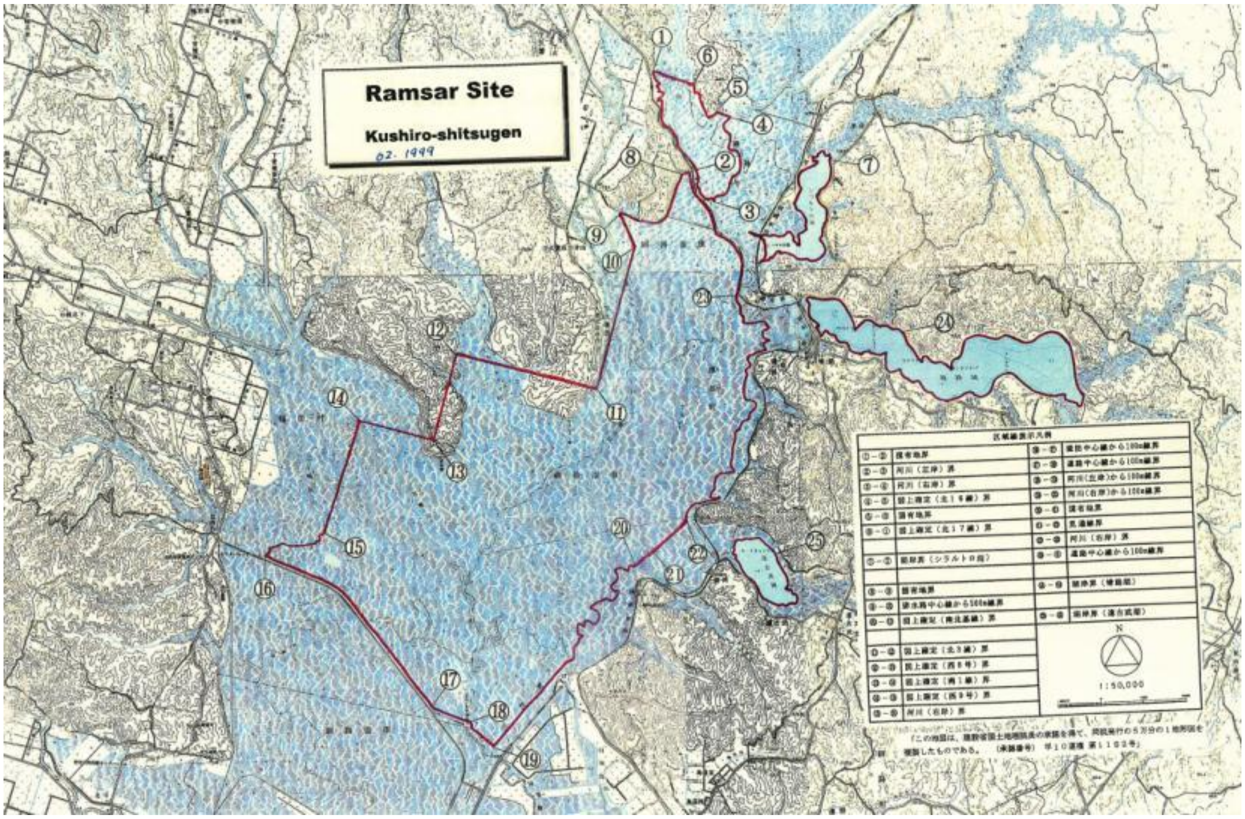

Figure 8.5. Map of the Kushiro-shitsugen Ramsar Site, boundary outlined in red. Source: Ramsar, 1999.

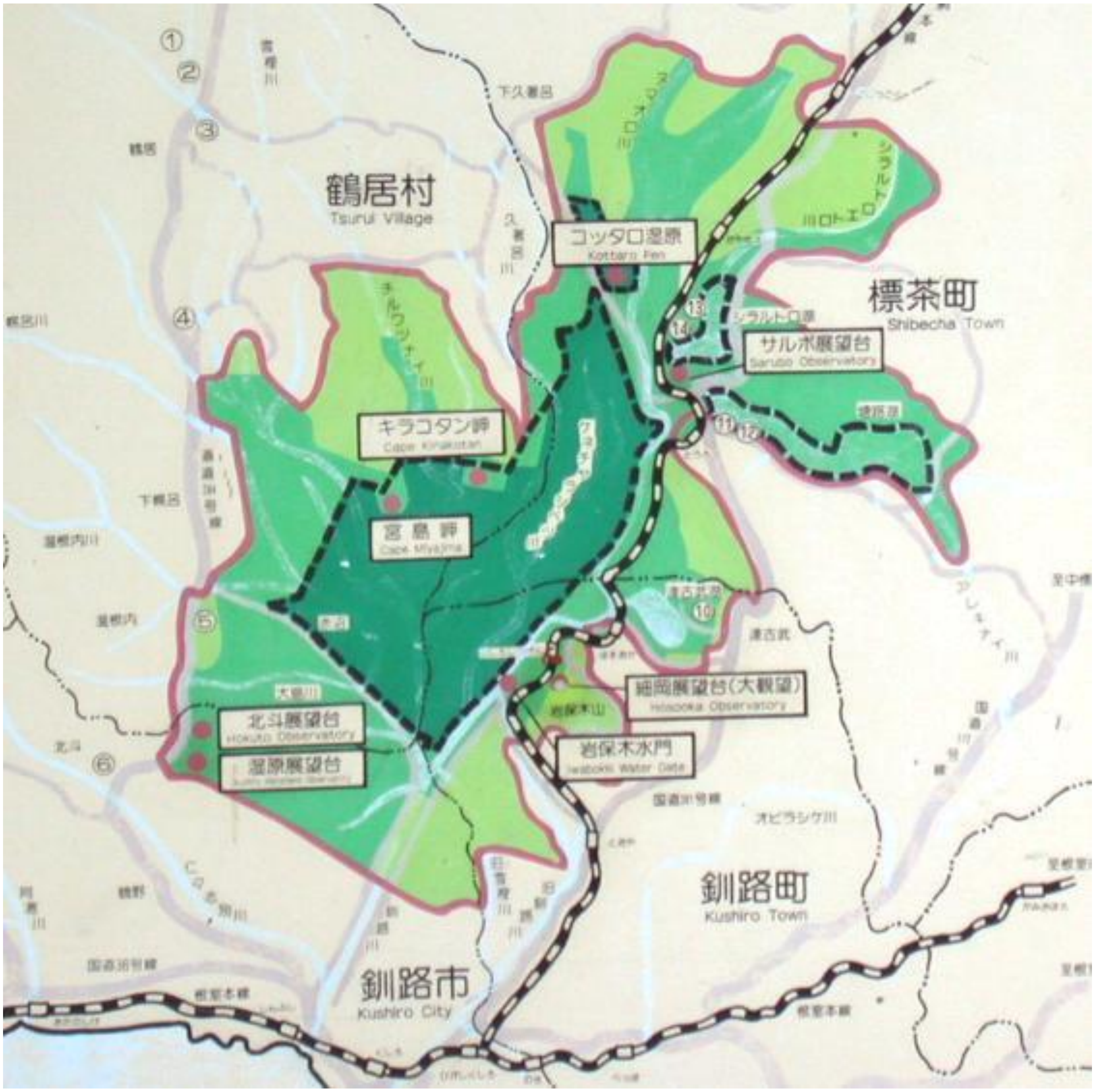

Figure 8.6. Kushiro-Shitsugen National Park (boundary shown in red) and Ramsar Site (boundary shown as a dashed black line), Hokkaido Prefecture, Japan. Source: Kushiro Shitsugen National Park.

As of 2013, there were three well-known artificial feeding stations supported by Japan's Ministry of the Environment that are also popular tourist destinations, the Akan International Crane Center, the Tsurui Ito Sanctuary, and the Tsurumidai Feeding Station (Cover Photo, Figs. 8.1, 8.2, and 8.3). The government of Hokkaido Prefecture provides support for an additional 25 artificial feeding stations in Kushiro (16), Nemuro (8), and Tokachi (1) Subprefectures (Government of Hokkaido, 2013). Private artificial feeding stations are also widespread, with at least 48 in Kushiro and Nemuro Subprefectures alone (Government of Hokkaido, 2013).

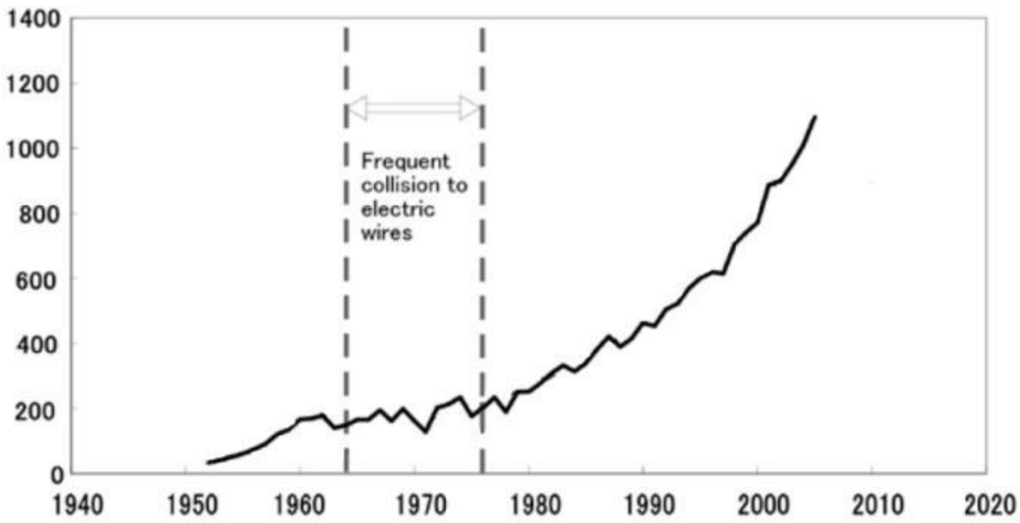

Figure 8.7. Increase in red-crowned crane numbers in Hokkaido Prefecture, Japan, 1952-2005. Source: Koga, 2008.

Table 8.1. Various annual red-crowned crane counts in Hokkaido Prefecture, Japan, 1924-2020.

Year	Count	Source
1924	20	Masatomi, 2008
1952	33	Koga, 2008
1991	453	Masatomi, 2008
1992	505	Masatomi, 2008
1993	522	Masatomi, 2008
1994	569	Masatomi, 2008
1995	500	Masatomi, 2008
1996	600	Masatomi, 2008
1997	619	Masatomi, 2008
1998	615	Masatomi, 2008
1999	706	Masatomi, 2008
2000	740	Masatomi, 2008
2001	771	Masatomi, 2008
2002	887	Masatomi, 2008
2003	898	Masatomi, 2008
2004	950	Masatomi, 2008
2008	1250	Koga, 2009
2013	1400	Momose and Momose, 2019
2018	1600	Mirande and Harris, 2019
2019	1650	TKG, 2020
2020	1800	TKG, 2020

Table 8.2. Location of red-crowned crane observation areas visited on January 25-26, 2020 in the west Kushiro Wetlands, Kushiro Subprefecture, Hokkaido, Japan.

Observation Location	Location (Japanese)	Latitude	Longitude
Akan International Crane Center	阿寒国際ツルセンター	43°08'36.38"N	144°08'56.65"E
Kushiro TMR Feed Cooperative	釧路 TMR	43°04'49.81"N	144°10'27.50"E

During this visit to the Kushiro area, the main national park wetland was not visited. Rather, crane counts were made at the Akan International Crane Center, located about 25 km northwest of Kushiro City, and the surrounding reclaimed farmlands of the Akan region to the south in the vicinity of the large Kushiro TMR feed cooperative (Figs. 8.1, 8.2 and 8.3, Table 8.2), as discussed below. This area is a center of the Hokkaido dairy farming industry that expanded rapidly after the war, largely through conversion of vast tracts of former valley bottom wetlands to pastures and haying areas for dairy cows as well as to cornfields for growing winter feed.

8.2. Field Methods

8.2.1. Kushiro: Day 1 – Akan River Valley Dairy Farming Region – January 25, 2020

The day began at 8:30 AM at the Akan International Crane Center with a morning meeting of crane survey team members, including researchers, conservationists, and volunteers. After the meeting, our survey team of two departed by car to look for cranes known to territorially occupy dairy farms as individual families in the lower Akan River Valley to the south and southeast of the crane center. This survey area included the TMR Feed Cooperative and the farming areas in the broad section of valley immediately to the east (Fig. 8.3). The survey was performed by: 1) sighting cranes from the car both with and without binoculars, 2) getting out and walking around farm buildings to look for cranes hidden from the road, and 3) occasionally knocking on a farmhouse door and asking about the status of cranes not seen at farms known to have crane families. Notes were kept on the number of cranes sighted at each farm and later compiled in a regional estimate with the observations of other teams. We returned to the Akan crane center at about 4:30 PM.

8.2.2. Kushiro: Day 2 – Akan International Crane Center – January 26, 2020

The entire day from 8:00 AM to 4:00 PM was spent at the Akan International Crane Center with the main survey team. Here, the day's fluctuations in crane numbers were monitored and documented on the center's large crane feeding area using the back deck of the crane center as a fixed observation point (Fig. 8.1). This involved: 1) a team of two making parallel counts of all cranes in the main feeding field behind the crane center every five minutes for eight hours using 10x binoculars and hand click counters, 2) a team of two making parallel notes of all cranes leaving the survey area, either by walking or flying away, and 3) a team of two making parallel notes of all cranes entering the survey area either by walking or flying in. A dedicated data recorder was stationed with the observers throughout the day who recorded all information gathered on data sheets.

8.3 Results

8.3.1. Kushiro: Day 1 – Akan Dairy Farming Region – January 25, 2020

Counts of red-crowned cranes sighted at the various farms visited in the vicinity of the Kushiro TMR feed cooperative in the Akan River Valley region northwest of Kushiro City are summarized in Table 8.3. In total, 32 cranes were tallied, all being sighted in family or breeding pair units.

Table 8.3. Red-crowned cranes counted on January 25, 2020 at dairy farms in the vicinity of the Kushiro TMR Feed Cooperative located south of the Akan International Crane Center in the lower Akan River Valley, west Kushiro Wetlands, Kushiro Subprefecture, Hokkaido, Japan.

Farm Name	**Number of Cranes**	**Notes**
Kikuchi	4	1 Family: 2a + 2j*
Akan Itse	3	1 Family: 2a + 1j
Hanzawa	3	1 Family: 2a + 1j
Otomo	3	1 Family: 2a + 1j
Nomura	3	1 Family: 2a + 1j
Shimizu	2	1 Adult Pair
TMR Feed Cooperative	2	1 Adult Pair – seen before lunch and again at sunset
Asano	3	1 Family: 2a + 1j
Otomo	3	1 Family: 2a + 1j
Jinsei III	2	1 Adult Pair
Oikawa	2	1 Adult Pair – next to Jinsei I
River dung piles	2	1 Adult Pair
Total	32	

*Note: a = adult, j = juvenile.

8.3.2. Kushiro: Day 2 – Akan International Crane Center – January 26, 2020

From just several cranes present at the Akan International Crane Center at 8:00 AM, following morning spreading of corn by tractor, crane numbers swelled to 175 by about 1:00 PM. Crane numbers remained at about that level for an hour before dwindling to zero by 4:00 PM as cranes returned to their respective roosting sites.

8.4. Discussion

The Hokkaido red-crowned crane population has been brought back from the brink of extinction by the concerted efforts of conservationists that have increased its numbers from a low of 33 cranes counted in 1952 to an estimated 1800 today (Table 8.1)(Koga, 2008; TKG, 2020). This dramatic increase in numbers is the result of: 1) systematic artificial feeding of cranes beginning in 1952 following a severe winter storm in Hokkaido (Koga, 2008); 2) initially at least, due to improved survey methods and knowledge of crane distribution in Hokkaido during the 1950s; 3) placement of markers on proliferating powerlines to prevent crane strikes during the 1960s and 1970s; 4) improved protection of the Kushiro Wetland following Ramsar and national park designation in the 1980s; and 5) improved public awareness of the threats to cranes, particularly among local farmers in crane areas of Hokkaido. Nevertheless, the red-crowned crane is still classified as endangered and remains the rarest of the Asian crane species (Table 1.2).

As elsewhere, threats to red-crowned cranes on Hokkaido persist. Perhaps the largest ongoing threat is simply the high concentration of red-crowned cranes around feeding stations at various locations in Hokkaido, which puts them at great risk for contracting avian diseases (Hartup and Mirande, 2019; Momose and Momose, 2019). A second threat to Hokkaido's red-crowned cranes is habitat destruction. In the Kushiro area alone, between 1975 and 1994 the area of wetlands decreased by 46.8 percent from 372.9 km^2 to 198.3 km^2 (Koga, 2008). With the

Hokkaido crane population more than doubling in the first two decades of the 21st Century, cranes have necessarily had to disperse and roost in smaller wetlands as overcrowding in prime roosting areas on the main Kushiro Wetland has increased. However, these smaller satellite wetlands have been disappearing rapidly since the end of World War II due to reclamation for agriculture (Koga, 2008; Koga, 2009; Momose and Momose, 2019). In total over 70 percent of Hokkaido's wetlands have been lost to development (Koga, 2008). A third threat in the first decade of the 21st Century was the use of various agricultural pesticides that were believed to be responsible for crane deaths in Hokkaido, while lead and mercury poisoning were also confirmed (Koga, 2008; Prentice et al., 2019).

Also related to agriculture is the threat of direct conflict between cranes and farmers. With cranes in Hokkaido becoming increasingly habituated to humans, this threat takes on two main forms: 1) crop damage as cranes feed on corn, potatoes, and other local crops (Koga, 2008; Masatomi, 2009), and 2) cranes startling dairy cows, occasionally leading to injury to cows, as cranes increasingly subsist on cattle feed set out for cows in winter (Momose, 2009). Although, the threat of crane strikes on power lines in Hokkaido was largely resolved in the 1970s by the placement of yellow plastic tubes on wires to increase their visibility, crane deaths from power line strikes persist (Koga, 2008; Momose and Momose, 2019). Another post war threat is that of cranes being hit by cars and trains as they cross roads and train tracks (Koga, 2008; Momose and Momose, 2019). Finally, another possible threat to cranes on Hokkaido is that of reduced genetic variability given the small starting point of the population at perhaps well under 100 individuals in the 1950s. This can lead to inbreeding, decline in reproductive viability, and reduce the ability of a population to adapt to future changes in the environment (Miller and Mirande, 2019). However, further studies are needed to assess the genetic viability of Hokkaido's red-crowned cranes.

9. Tokachi Wetlands

Tokachi Subprefecture, Hokkaido Prefecture, Japan

Dates Visited: January 27-28, 2020

9.1. Site Description and Background

The Tokachi Subprefecture (十勝, 42°55'05.01"N, 143°12'07.34"E) red-crowned crane areas are located roughly 95 km west of Kushiro City in the Tokachi, Rekifune, and Toberi River basins (Figs. 1.1, 9.1, 9.2, and 9.3). Winter crane feeding areas here are predominantly agricultural areas that include both dairy farms, where cranes eat cattle feed, and croplands, where cranes feed on waste grain and other crops. The majority of wetlands in the Tokachi area were reclaimed for agriculture during the 20th Century (Koga, 2008). Consequently, crane roosts in Tokachi are generally small, and include various rivers, streams, and ponds (Koga, 2008). In the 1980s, there were only a few crane breeding pairs in Tokachi (Koga, 2008). However, since that time, with increasing crowding on breeding sites in the Kushiro Wetland, red-crowned cranes have steadily expanded their range westward from Kushiro to Tokachi, where extensive croplands provide an abundance of food for cranes (Koga, 2008). As of 2005, there were about 50 crane pairs nesting in Tokachi, with most nests built in small wetlands (Koga, 2008).

In general, winter crane sites with unfrozen rivers are limited in Tokachi, since few unfrozen rivers have adequate natural food supplies for cranes due to channelization and concreting of streams (Koga, 2008). However, as of 2008, efforts were underway to establish new wintering sites in Tokachi (Masatomi, 2009). In this regard, work is underway to create a new wintering site on the Tokachi River about 1.5 km east of the Tokachi Ecology Park visitor center (42°56'01.06"N, 143°18'37.74"E)(Fig. 9.4). This involves establishment of an artificial feeding station and roosting site at an artificially deepened flood control channel in the Tokachi River that is groundwater fed and does not freeze in winter (Wada, 2009).

9.2. Field Methods

As at the Akan International Crane Center on January 25-26, the January 2020 Tokachi Subprefecture crane survey was conducted by a coalition of researchers, conservationists, and volunteers. These participants were divided into about five survey team subgroups that each covered a different assigned survey block using maps provided by the survey leader. The survey was carried out on two consecutive days, on January 27th in the vicinity of Churui, located 40 km south of the Tokachi Subprecture capital, Obihiro, and on January 28th in the vicinity of Ikeda, located 20 km east of Obihiro. Areas surveyed by the author’s three-person survey team subgroup are shown in Figs. 9.2, 9.3, and 9.4 (Table 9.1). On both days, surveys were conducted from about 10:00 AM until 3:30 PM. Survey methods used were similar to those used on January 25th in the Akan Dairy Farming region near Kushiro (see Section 8). These included driving

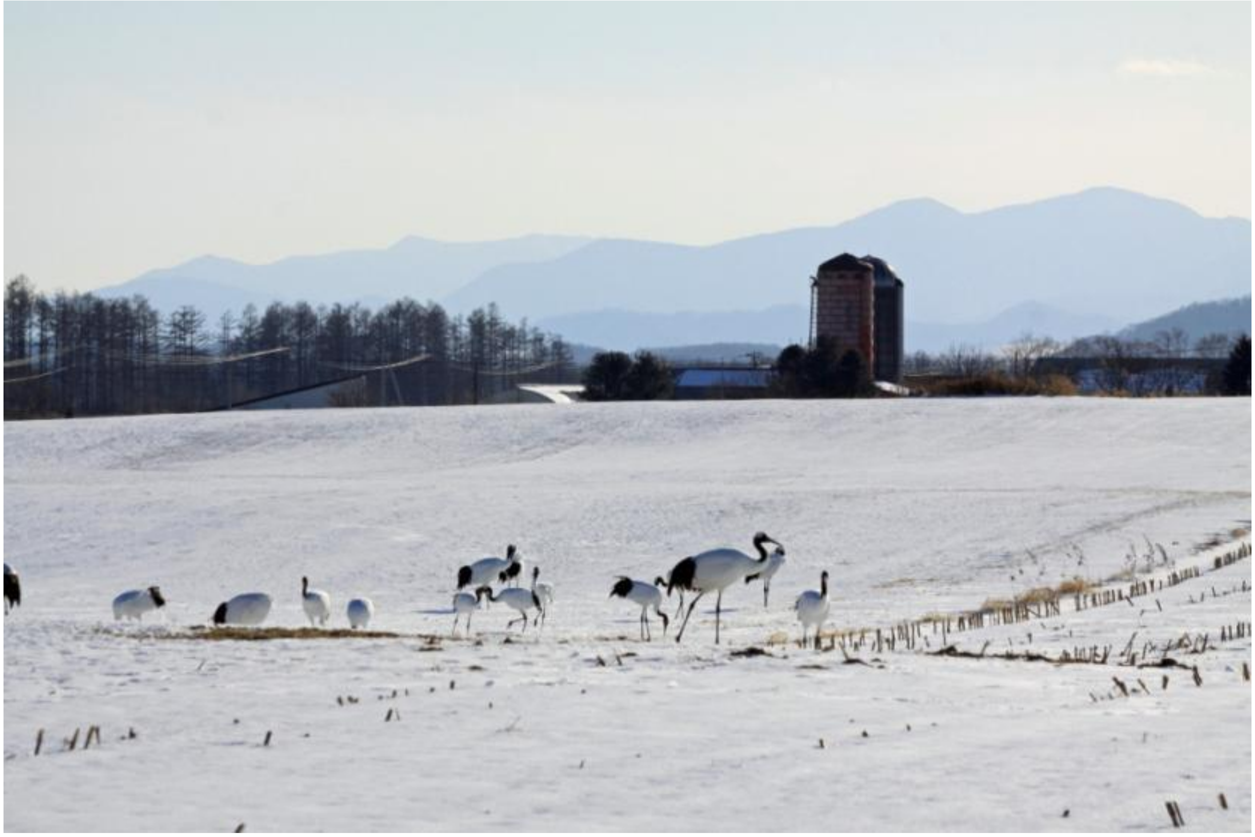

Figure 9.1. Red crowned cranes *Grus* j*aponensis* at the Road 55 Observation Point on the Maeda Farm in the lower Rekifune River Valley, Tokachi Subprefecture, Hokkaido, Japan (Fig. 9.3, Table 9.1).

Table 9.1. Location of primary red-crowned crane observation areas visited on January 27-28, 2020 in the Tokachi Wetlands, Tokachi Subprefecture, Hokkaido, Japan.

Observation Location	**Location (Japanese)**	**Latitude**	**Longitude**
Monday, January 27, 2020			
Crane Survey Meeting Point: Churui	集合地：忠類道の駅	42°33'32.59"N	143°17'55.24"E
Observation Point – Road 657: Momiji Bridge, Toberi River	当縁川紅葉橋	42°33'53.13"N	143°20'34.35"E
Observation Point – Road 55: Maeda Farm, Taiki Town	大樹町芽武 前田牧場	42°29'23.37"N	143°21'12.73"E
Tuesday, January 28, 2020			
Crane Survey Meeting Point - Ikeda	集合地：池田駅	42°55'13.46"N	143°27'11.73"E
Tokachichuo Bridge	十勝中央大橋	42°55'51.94"N	143°17'34.02"E
Makubetsu, Satsunai - Shiroki Farm	幕別町札内：白木牧場	42°55'42.65"N	143°15'19.96"E
Tokachigawa Onsen Daiichi Hotel	十勝川温泉 第一ホテル	42°55'58.32"N	143°17'48.97"E
Urahoro	浦幌	42°48'34.15"N	143°39'29.88"E

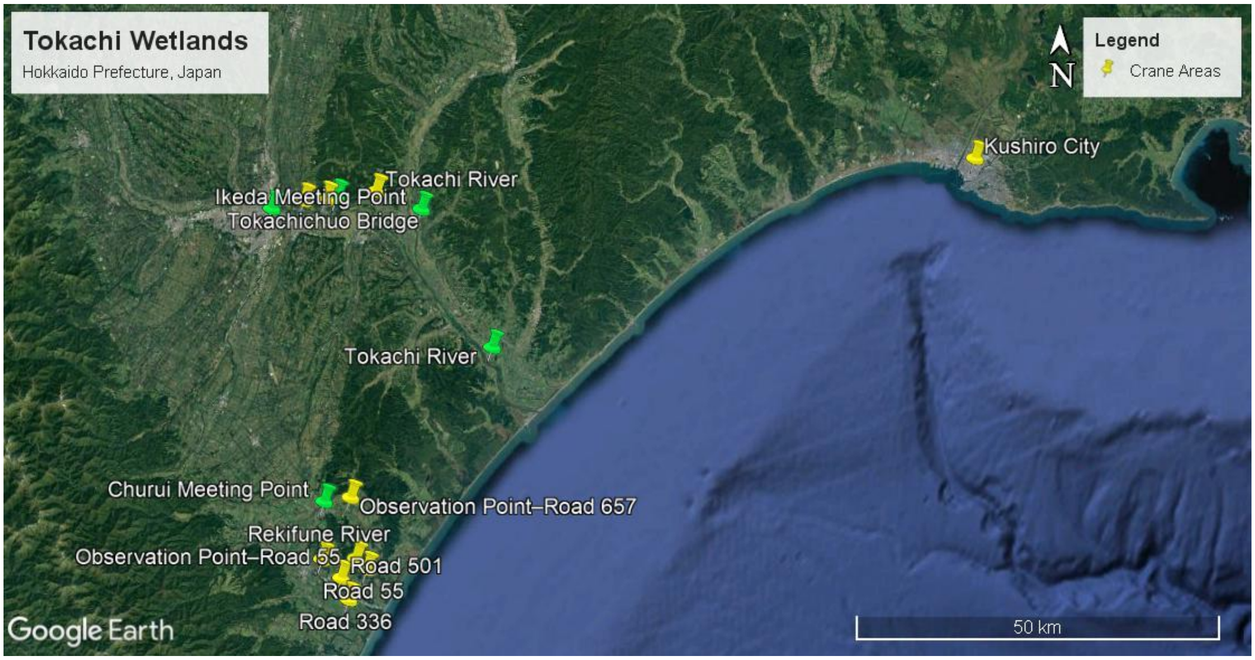

Figure 9.2. Overview of the Tokachi Wetlands, Tokachi Subprefecture, Hokkaido, Japan.

through farming areas to make opportunistic counts of cranes feeding in fields and farmyards as well as visiting locations known to regularly have cranes present and searching for these cranes.

9.2.1. Tokachi: Day 1 – Churui Area – January 27, 2020

Following a morning meeting of all survey participants at the Churui Road Station, our survey subgroup of three was assigned to survey the agricultural areas along Road 657 east of Churui and Road 55 southeast of Churui as well as along Highway 336 immediately south of the Rekifune River (Fig. 9.3, Table 9.1). Most cranes were sighted opportunistically from the vehicle both with and without binoculars while at one location on Road 657, we walked across a snowy field to look for cranes in a valley below using a spotting scope. Crane locations and counts were marked on a map of the assigned survey block provided by the survey team leader.

9.2.2. Tokachi: Day 2 – Ikeda Area – January 28, 2020

Following a morning meeting of all survey participants at the Ikeda train station, our survey subgroup of three was assigned to survey the area along the Tokachi River immediately east of Obihiro, including in the vicinity of the Tokachichuo Bridge, Tokachigawa Onsen Daiichi Hotel, Satsunai Garden Park and Castle, and surrounding agricultural fields (Figure 9.4, Table 9.1). This was primarily done from the vehicle using binoculars but also included stops that were surveyed on foot along the Tokachi River dike and in wooded riparian areas along the Tokachi River near the Tokachigawa Onsen Daiichi Hotel.

9.3. Results

Over the course of the entire two-day survey in Tokachi Subprefecture, collectively all survey participants counted a total of 217 red-crowned cranes. These included 146 cranes counted on

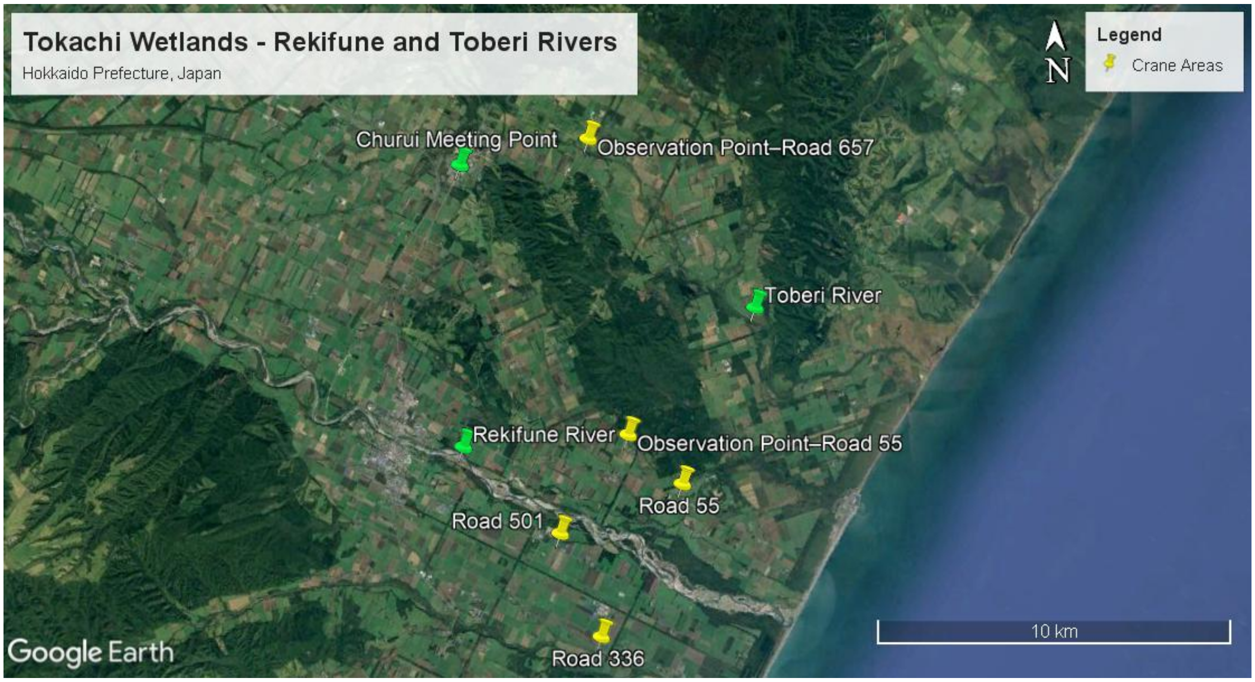
Tokachi Wetlands - Rekifune and Toberi Rivers
Hokkaido Prefecture, Japan
N
Legend
Crane Areas
Churui Meeting Point
Observation Point–Road 657
Toberi River
Rekifune River
Observation Point–Road 55
Road 55
Road 501
Road 336
10 km
Google Earth

Figure 9.3. Rekifune and Toberi Rivers red-crowned crane survey area, Tokachi Subprefecture, Hokkaido, Japan.

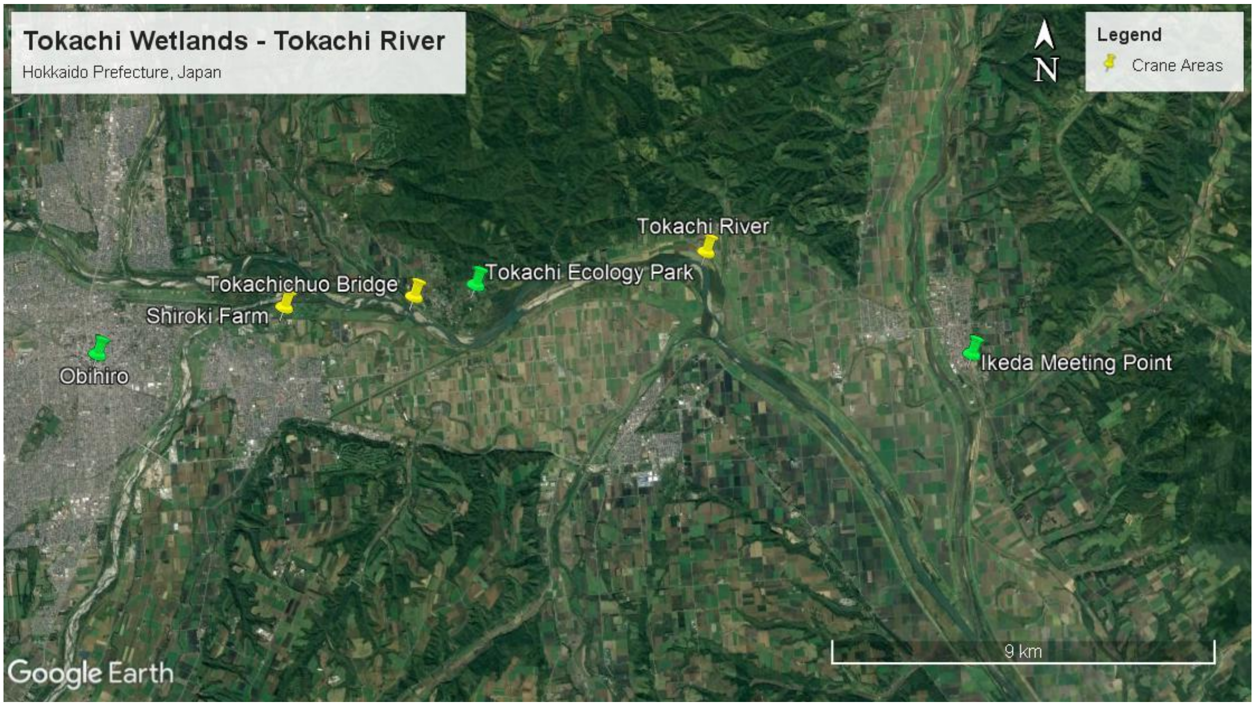

Figure 9.4. Tokachi River red-crowned crane survey area, Tokachi Subprefecture, Hokkaido, Japan.

January 27th in the Churui area and 71 counted on January 28th in the Ikeda area (Yulia Momose, personal communication, 24 June 2020). This represents approximately 12 percent of the entire Hokkaido red-crowned crane population, which was estimated to be 1800 in the winter of 2020 (TKG, 2020). A discussion of sightings by the author's survey team subgroup follows.

9.3.1. Tokachi: Day 1 – Churui Area – January 27, 2020

Counts of red-crowned cranes sighted by our three-person survey subgroup at various locations visited in the vicinity of Churui in Tokachi Subprefecture are summarized in Table 9.2. In total our survey subgroup counted 104 cranes, including a group of 18 feeding in a snowy field along Road 657, and a group of 71 feeding around covered cattle feed piles along Road 55 (Fig. 9.1, Table 9.2). The only cranes not sighted in farmyards or open agricultural fields were two cranes observed beside a forested reach of the Rekifune River along Highway 336.

Table 9.2. Red-crowned cranes counted at farms in the Churui and Taiki area, Tokachi Subprefecture, January 27, 2020.

Farm/Location Name	Number of Cranes	Notes
Usuki Farm	3	1 Family: 2 adults + 1 juvenile
Mukai Farm	18	Road 657 Observation Point
Taiki-cho Meimu, Maeda Farm	71	Road 55 Observation Point – Front Field Holsteins
Taiki-cho Meimu	3	Farm north of the Memu River
Taiki-cho Meimu	2	Along a forested area of the Rekifune River
Taiki-cho Hikata, Sanei Farm	5	Along Highway 336
Taiki-cho Seika, Takahashi Farm	2	Farm near the Okimanae Bridge on Highway 336 (outside the survey block)
Total	104	

9.3.2. Tokachi: Day 2 – Ikeda Area – January 28, 2020

Counts of red-crowned cranes sighted by our survey group in the Ikeda area of Tokachi Subprefecture are summarized in Table 9.3. In total, we observed 26 cranes in three generalized areas along the Tokachi River east of Obihiro. All cranes were sighted in open fields or near farm compounds.

Table 9.3. Red-crowned cranes counted in the Ikeda area, Tokachi Subprefecture, January 28, 2020.

Location Name	Number of Cranes	Notes
Tokachichuo Bridge	7	2 Families: 2a + 2j, 2a + 1j*
Makubetsu Satsunai	9	1 Family: 2a+1j; 4a, 2a
Makubetsu Satsunai, Shiroki Farm	10	6a, 2a, 2a
Total	26	

*Note: a = adult, j = juvenile.

9.4. Discussion

As in the Akan area on January 25th, with the exception of two cranes sighted in a riparian forest corridor along the Rekifune River, all cranes sighted in Tokachi were in agricultural fields or around cattle feed piles near farm buildings. Apart from two large crane groups of 18 and 71 seen on January 27th, the remainder were seen in family or breeding pair groups. Threats to cranes in Tokachi closely parallel those discussed for the Kushiro area. As in Kushiro, the area of wetlands in Tokachi declined rapidly from 55.9 km^2 in 1975 to 22.5 km^2 in 1994 due to reclamation of wetlands for agriculture, a decline of 59.7 percent (Koga, 2008). In spite of this fact, crane numbers in Tokachi continued to increase from a few breeding pairs in the 1980s to the 217 cranes counted during the survey of January 27-28, 2020.

The most notable difference in threats between Kushiro and Tokachi is perhaps the degree of conflict with crop farmers in Tokachi. As of 2007, croplands, including wheat, beans, potatoes, and sugar beets, only comprised 12.65 km^2 or 1.6 percent of the 771.29 km^2 of agricultural lands in Kushiro's crane breeding areas, the remainder being pastures and haying areas (Koga, 2008). However, in Tokachi, croplands make up 182 km^2 or 48.5 percent of the 375 km^2 of agricultural lands in crane breeding areas (Koga, 2008). Consequently, it comes as no surprise that many farmers are not happy about the westward expansion of cranes to the Tokachi area, where cranes are causing severe damage to corn, beans, and wheat as well as root crops such as potatoes and sugar beets (Koga, 2008; Masatomi, 2009). Thus, conservationists will need to work with farmers to devise strategies to reduce and mitigate this crane-farmer conflict.

10. Other Important Winter Crane Sites in Northeast Asia

There are a number of other important winter crane sites in Northeast Asia that the author did not visit during the winter of 2019-2020. Brief descriptions follow of the five most important of these sites.

10.1. Other Winter Crane Sites in China

10.1.1. Jiangsu Yancheng Wetland Rare Bird National Nature Reserve, Jiangsu Province

The Jiangsu Yangcheng Wetland Rare Bird National Nature Reserve (commonly known as the Yancheng National Nature Reserve, 江苏盐城湿地珍禽国家级自然保护区, 33°36'02.96"N, 120°30'30.90"E) covers a roughly 250 km long strip of coastline on the Yellow Sea between the mouths of the Guan and Xingang Rivers in central Jiangsu Province (Figs. 1.1, 10.1, and 10.2, Table 10.1). The reserve has an area of 2472.6 km^2 and was first established in February 1983 as a provincial level nature reserve. It was later upgraded to a national level nature reserve in October 1992 (Baike, 2020a). On November 1, 2002, the 4530 km^2 Yancheng National Nature Reserve Ramsar site was established, which covers China's largest coastal wetland and its expansive mudflats. This site supports high biodiversity that includes about 3 million individuals of 200 bird species that migrate through the site annually (Ramsar, 2020c). Notably the site is the most important wintering ground in China for red-crowned cranes, with about 350 counted there in the winter of 2013 (Momose and Momose, 2019). Common, hooded, sandhill, white-naped, and Siberian cranes have also been recorded at Yancheng in recent years (Ebird, 2020b). The reserve also supports about 10 percent of the world's remaining black-faced spoonbills and is one of the two largest range areas in China for the Pere David's deer (*Elaphurus davidianus*) (Ramsar, 2020c). Because of the reserve's importance for biodiversity, on July 5, 2019, sections of the reserve were inscribed upon UNESCO's World Heritage List as part of the Migratory Bird Sanctuaries along the Coast of Yellow Sea-Bohai Gulf of China (Phase I) World Heritage property (Fig. 10.3)(UNESCO, 2020).

Table 10.1. Location of the Yancheng National Nature Reserve, Jiangsu Province, China and its northern and southern boundary rivers.

Location	Location (Chinese)	Latitude	Longitude
Yancheng National Nature Reserve	盐城国家自然保护区	33°36'02.96"N	120°30'30.90"E
Guan River	灌河	34°27'47.48"N	119°47'06.71"E
Xingang River	新港河	32°37'02.62"N	120°59'53.83"E

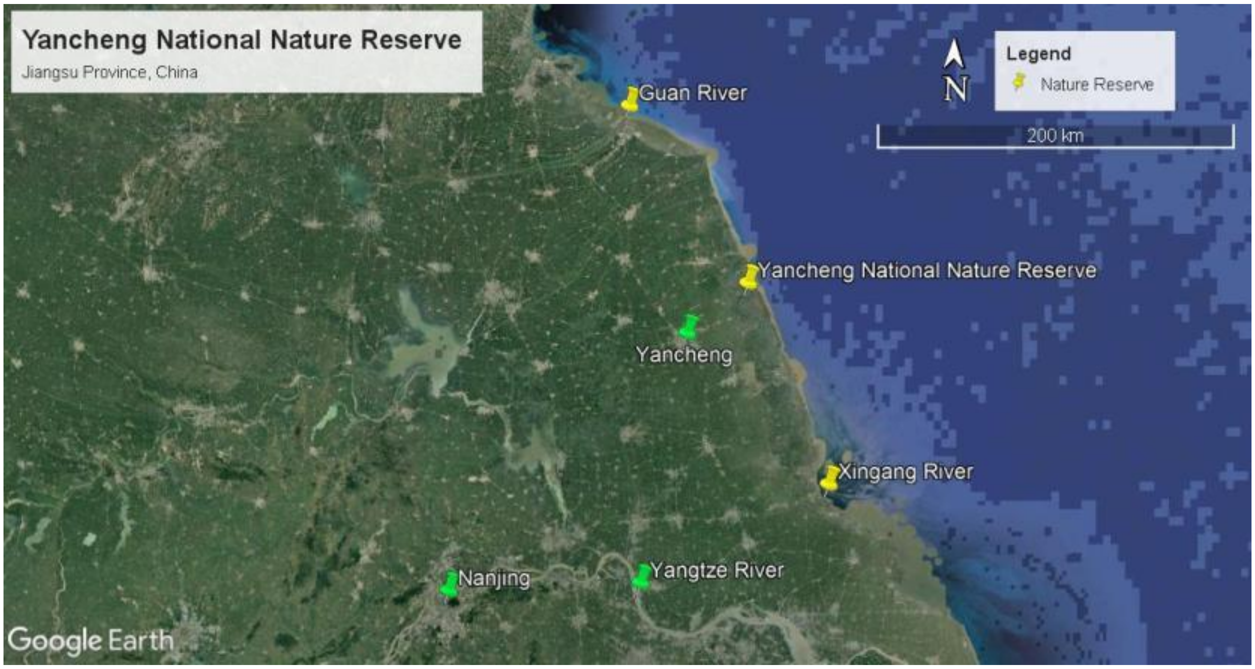

Figure 10.1. Overview of the Yancheng National Nature Reserve, Jiangsu Province, China, including Nanjing, the Jiangsu provincial capital located on the Yangtze River.

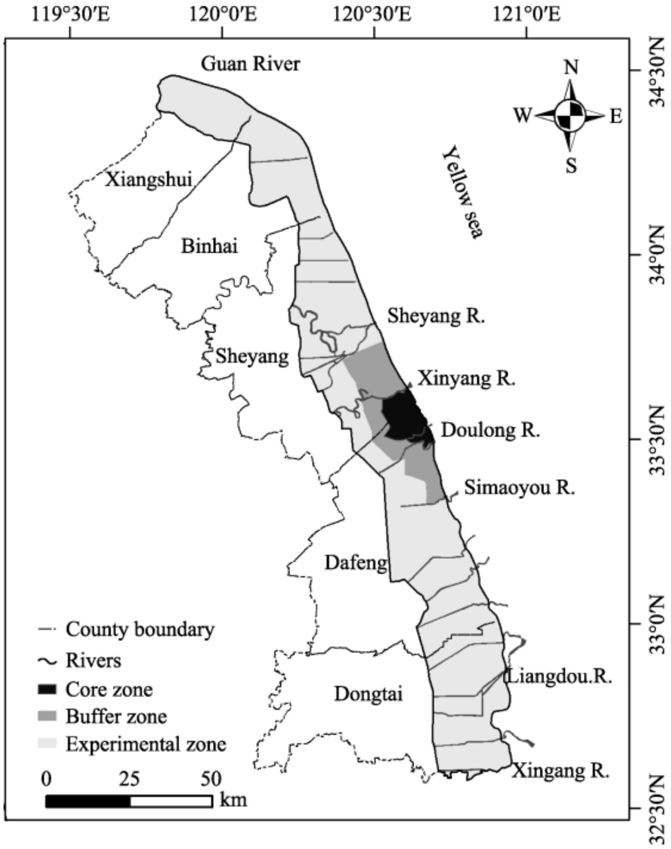

Figure 10.2. Map of the Yancheng National Nature Reserve, Jiangsu Province, China. Source: Liu et al., 2013.

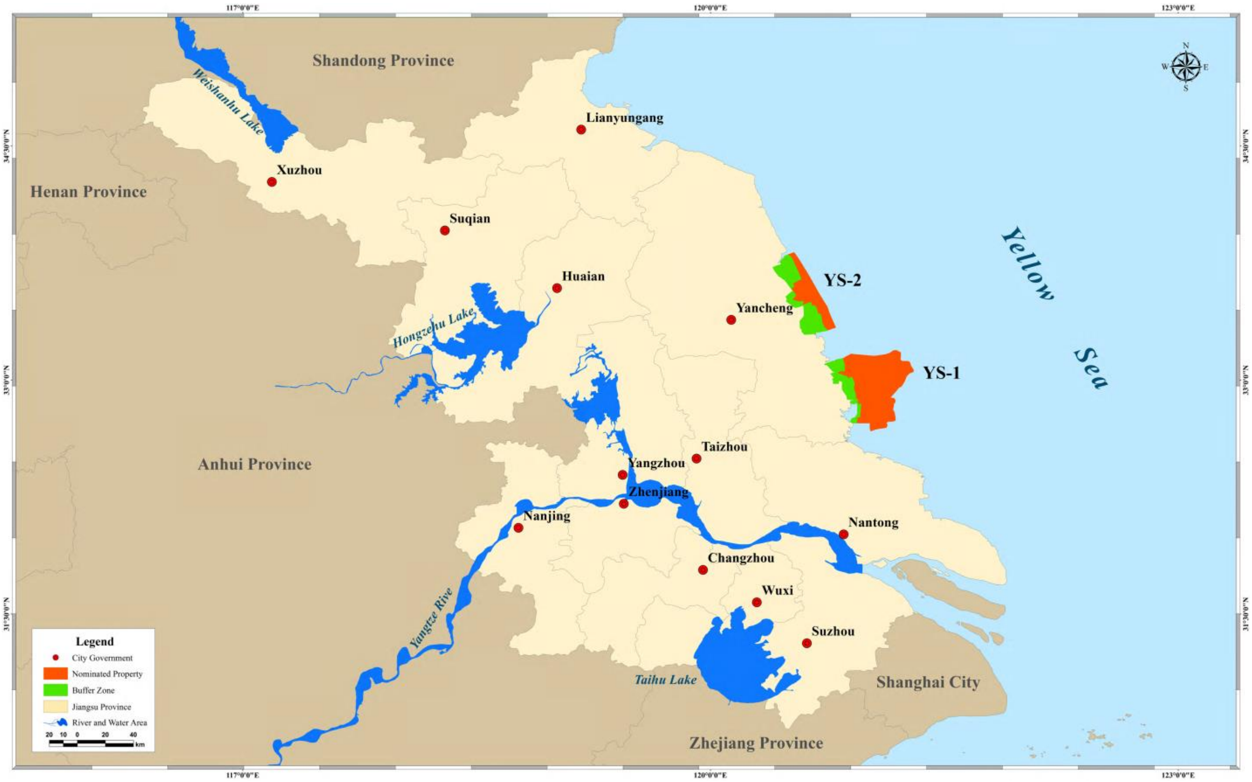

Figure 10.3. Map of the Migratory Bird Sanctuaries along the Coast of Yellow Sea-Bohai Gulf of China (Phase I) World Heritage Site centered on the Yancheng National Nature Reserve, Jiangsu, China. Red: Nominated World Heritage site property, Green: Nominated World Heritage site property buffer zone. Source: UNESCO, 2020.

10.1.2. Shandong Yellow River Delta National Nature Reserve, Shandong Province

The Shandong Yellow River Delta National Nature Reserve (山东黄河三角洲国家级自然保护区, 37°47'17.03"N, 118°54'40.13"E) is located at the mouth of the Yellow River on the Bohai Sea in Shandong Province (Figs. 1.1, 10.4, and 10.5). The reserve was established in 1992 and has a total area of 1530 km^2 that is divided into two sections. The smaller northern section has an area of 485 km^2 that was formerly the mouth of the Yellow River until its main channel was diverted in 1976 to what is now the southern section of the reserve, area 1045 km^2 (Figs. 10.4 and 10.5)(Baike, 2020b). On October 16, 2013, the 959.5 km^2 Shandong Yellow River Delta Wetland Ramsar Site was established centered on the core zones of the two nature reserve sections (Fig. 10.6). Ramsar designation was granted in recognition of the reserve's international importance for migratory waterbirds, which numbered over 300,000 in the winter of 2007–2008, including internationally important numbers of 38 species (Ramsar, 2020d; Li et al., 2013).

Wetlands on the broader Yellow River delta cover 6237 km^2, 73.5 percent of which are natural wetlands, such as marshes and tidal flats, while 26.5 percent are artificial wetlands, including aquaculture ponds, the shallow Gubei Reservoir, saltpans, rice paddies, and irrigation canals (Li et al., 2013; Cao et al., 2015). Notably, the delta has an accretion rate of 32.4 km^2/year, one of the fastest in the world, due to the Yellow River's extremely high sediment load which gives the river its name (Ramsar, 2020d).

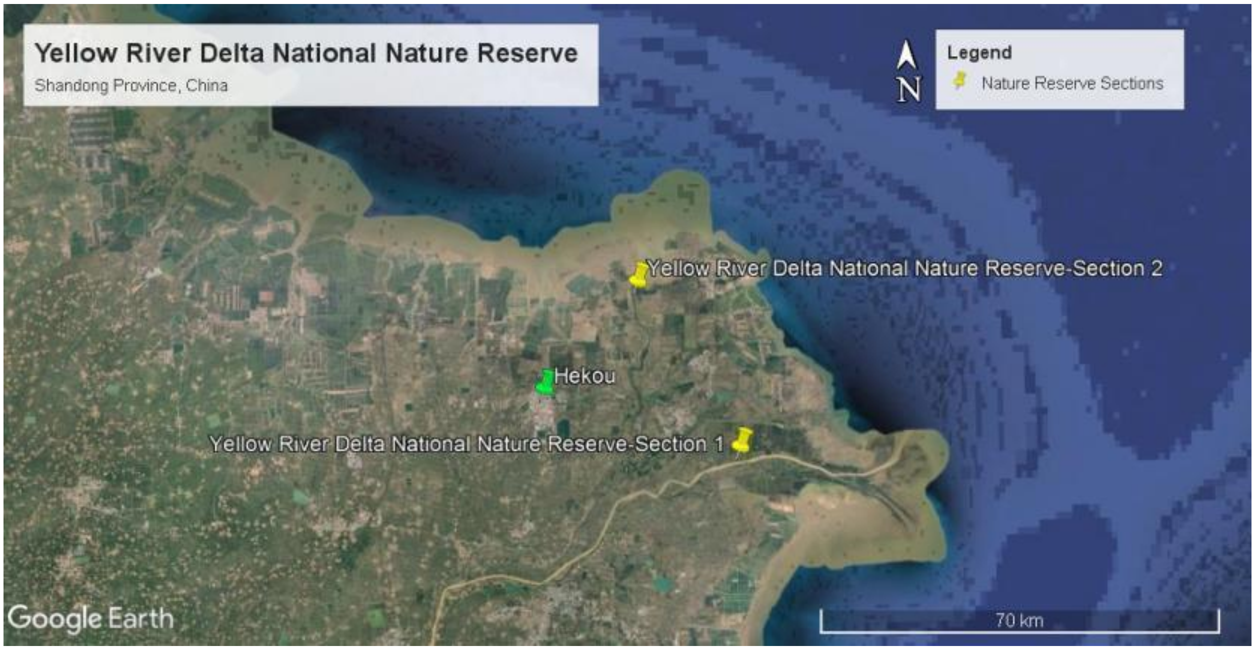
Yellow River Delta National Nature Reserve
Shandong Province, China
N
Legend
Nature Reserve Sections
Yellow River Delta National Nature Reserve-Section 2
Hekou
Yellow River Delta National Nature Reserve-Section 1
Google Earth
70 km

Figure 10.4. Overview of the Yellow River Delta National Nature Reserve, Shandong Province, China.

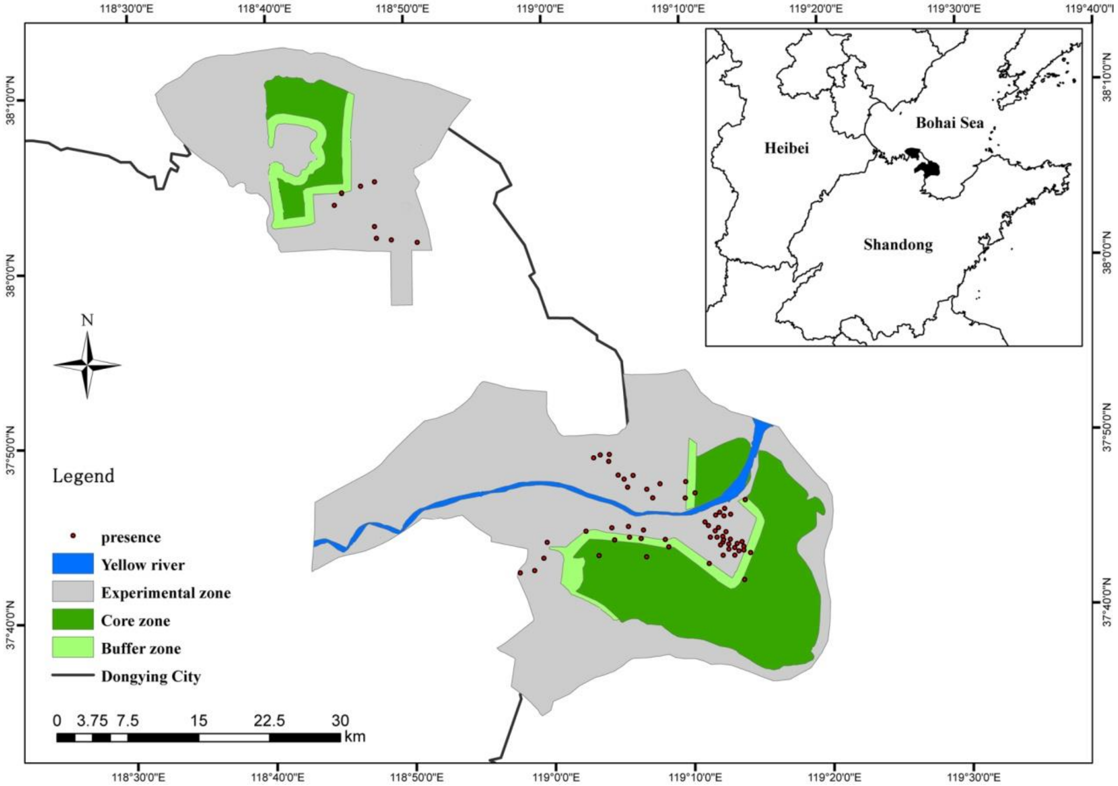

Figure 10.5. Map of the Yellow River Delta National Nature Reserve, Shandong Province, China showing red-crowned crane sighting locations ("presence" points), October to December 2007. Source: Cao et al., 2015.

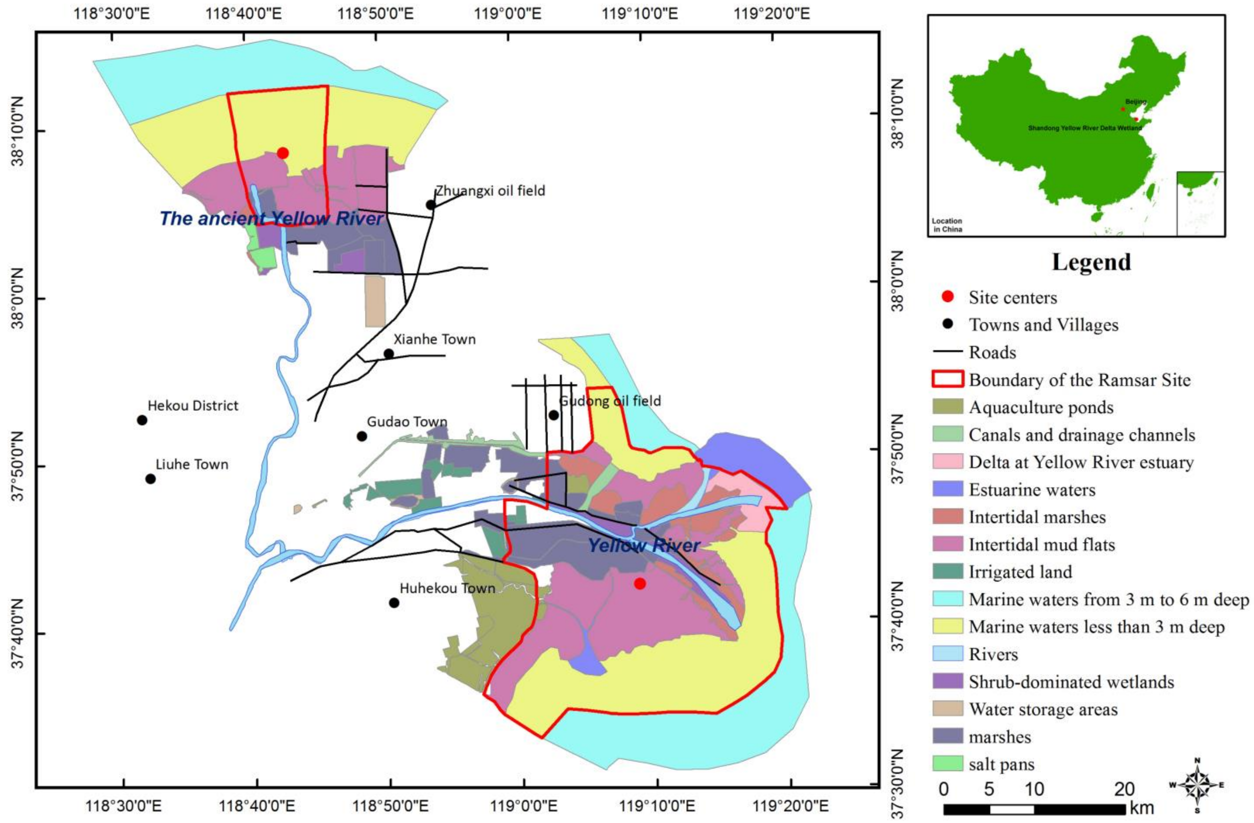

Figure 10.6. Map of the Shandong Yellow River Delta Wetland Ramsar Site, Shandong Province, China. Source: Ramsar, 2020d.

With respect to cranes, the Yellow River delta's importance as a wintering ground for cranes has declined dramatically since the late 20th Century, although it remains an important stopover site for cranes en route to and from Poyang Lake in Jiangxi Province. Formerly, the delta was a major wintering site for common cranes, but their numbers there have declined to almost zero since 2000 while a survey conducted on the delta in the winter of 2012-2013 found just seven red-crowned cranes wintering there (Prange and Ilyashenko, 2019; Momose and Momose, 2019). Nevertheless, a 1995 satellite tracking study of Siberian cranes found the Yellow River delta to be one of the four most important stopover sites for Siberian cranes migrating from Yakutia, Siberia to Poyang Lake, Jiangxi (see Section 2), with one tracked crane spending October 8-9, 1995 on the delta (Kanai et al., 2002). A 2007-2008 study on habitat use by migratory birds on the Yellow River delta found hooded, common, and white-naped cranes feeding on delta paddy fields, with red-crowned cranes also present on the delta. A peak count of 299 cranes of five species were found on natural delta wetlands, while a peak count of 196 cranes of three species were sighted on rice paddies and a peak count of 155 cranes of five species were found on the delta's aquaculture ponds (Li et al., 2013). The Yellow River delta is also considered to be the most important wintering ground in east Asia for the vulnerable great bustard (*Otis tarda*) as well as being an important site for the endangered oriental stork (Kanai et al., 2002).

However, since the 1970s, flow from the Yellow River has decreased, resulting in degradation of the delta's wetlands, a problem that will likely only worsen in coming decades with rising sea levels and the loss of more sediment behind dams on the Yellow River (Cao et al., 2015; Kong et al., 2015; Ramsar, 2020d). Loss of natural delta wetlands to marsh reclamation for agriculture and development continues to be an issue as well (Cao et al., 2015). Another large threat to bird habitat on the Yellow River delta is the fact that it is the location of one of China's three largest oil fields, the Shengli Oil Field (Kanai et al., 2002; Cao et al., 2015)

10.2. Other Winter Crane Sites on the Korean Peninsula

10.2.1. Junam Reservoirs, South Gyeongsang Province, South Korea

The Junam Reservoirs (주남저수지, 35°18'50"N, 128°40'30"E) are a series of three small interconnected reservoirs located 40 km northwest of Busan in South Gyeongsang Province (Fig. 10.7). They consist of the Junam, Dongpan, and Sannam Reservoirs which have areas of 2.85 km^2, 2.42 km^2, and 0.75 km^2, respectively (Kim and Joo, 2019). These shallow reservoirs have an average depth of 3 m and a maximum depth of 7 m (Kim and Joo, 2019). The eastern side of the reservoirs is completely covered in agricultural fields, predominantly rice and barley, although greenhouse agriculture is increasing in the area (Kim et al., 2015). The western side of the reservoirs consists of low hills covered in a patchwork of forests, agricultural fields, and developed areas.

The agricultural fields east of the reservoirs currently have the third largest number of over-wintering white-naped cranes on the Korean Peninsula after Cheorwon and Yeoncheon Counties. The number of white-naped cranes at Junam has increased dramatically from a low count of just two in 1997 to 330 in January 2020 (Table 10.2). Small numbers of hooded cranes (<10) have also been recorded at the reservoirs in recent years. As elsewhere in Korea, potential sources of human disturbances to cranes at Junam include motor vehicle, bicycle, and equestrian traffic as well as fishermen and other visitors to the area (Kim et al., 2015). The growth in the number of greenhouses and farm roads as well as fluctuating reservoir water levels are also concerns for crane conservation at this site (Lee et al., 2006; Kim et al., 2015).

In addition, over 10,000 migratory waterfowl overwinter at the Junam Reservoirs (Yu et al., 2012). These include large numbers of Baikal teal, bean goose, greater white-fronted goose, whooper swan, tundra swan, swan goose, and Eurasian spoonbill (Lee et al., 2006; Yu et al., 2012; Kim et al., 2015; and Kim at al., 2019).

Table 10.2. Various annual white-naped and hooded crane counts at the Junam Reservoirs, South Gyeongsang Province, South Korea, 1997-2020.

Date	**Number of White-naped Cranes**	**Number of Hooded Cranes**	**Source**
1997	2	No Data	Kim et al., 2015
2001	30–70	No Data	Lee et al., 2006
2009	188	No Data	Kim et al., 2015
2011	150	9	Yu et al., 2012
2014.01.26	183	No Data	Kim et al. 2015
2020.01.19	330	2	NIBR, unpublished data

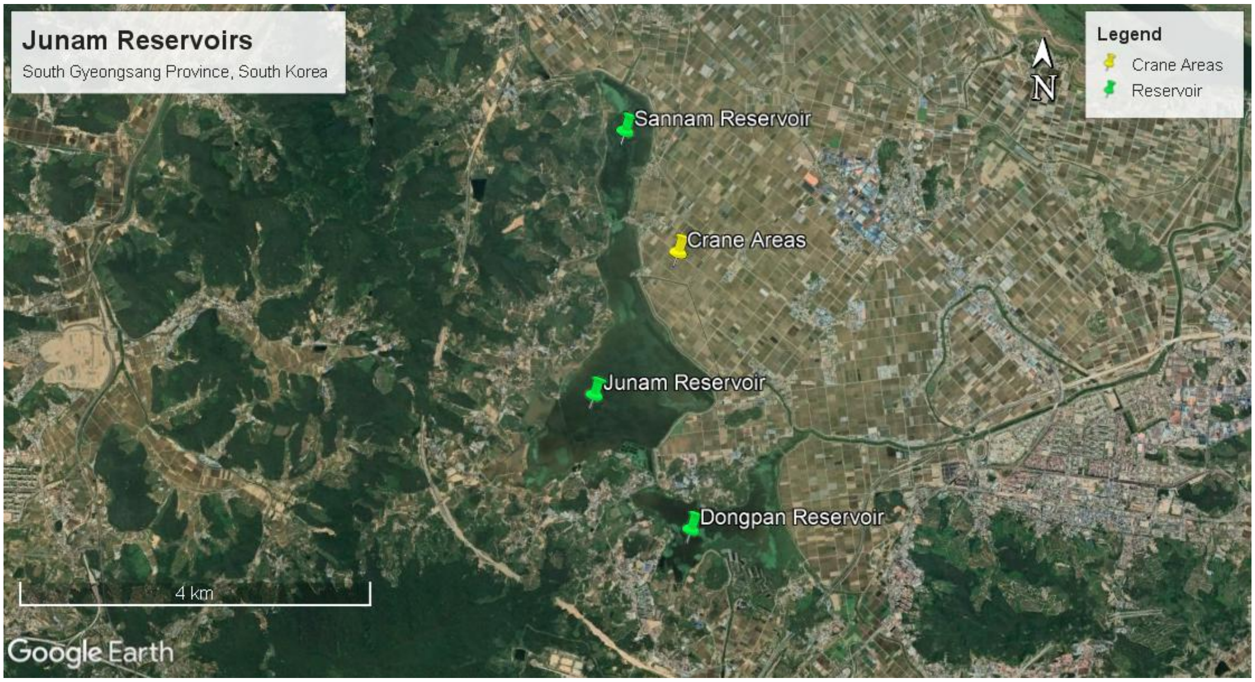

Figure 10.7. The Junam Reservoirs and white-naped crane winter feeding areas, South Gyeongsang Province, South Korea.

10.2.2. Paju Municipality Gyeonggi Province, South Korea

Paju Municipality (파주시, 37°45'34.04"N, 126°46'40.33"E) is located about 28 km northwest of Seoul, near the confluence of the Imjin and Han Rivers. The Imjin River northwest of Paju on the North Korean border is a significant crane site (Figure 10.8). As at Yeoncheon County (see Section 5), both red-crowned and white-naped cranes are found feeding in the river and on riverside agricultural lands. However, the area is said to be in decline as a crane site due to the rapid pace of development in the municipality. Unfortunately, at the time of my visit in January 2020, Paju and much of the DMZ were closed to outside visitors, including all DMZ bus tours. This was due to an outbreak of African Swine Flu along the North Korean border that threatened South Korea's pig farming industry.

In the past there were estimated to be 30-50 red-crowned cranes that wintered in Paju. However, in January 2008, only 10 were observed (Lee, 2009). An early 1993 satellite tracking study by Lee (2018) found that red-crowned cranes wintering at Paju used agricultural areas 45 percent of the time and mudflats 20 percent of the time. White-naped crane counts at Paju from 1999 and 2007 were highly variable with four counts during this period as follows: 1) 1999: 24, 2) 2005: 79, 3) 2006: 8, 4) 2007: 59 (Park, 2008). Reasons believed to be behind the decline in crane numbers at Paju include: 1) changing agricultural practices, such as the near total collection of straw after harvest which eliminates waste grain cranes depend on, 2) construction of new roads and train lines in Paju, including through agricultural areas favored by cranes, and 3) increased tourism and other development activities in Paju (Lee, 2009). Nevertheless, as elsewhere along the border with North Korea in Yeoncheon and Cheorwon Counties, red-crowned and white-naped crane populations in Paju underwent dramatic increases in the 2010s. And on January 17, 2020, a crane survey of Paju found 49 red-crowned cranes, 293 white-naped cranes, and one hooded crane (NIBR, unpublished data).

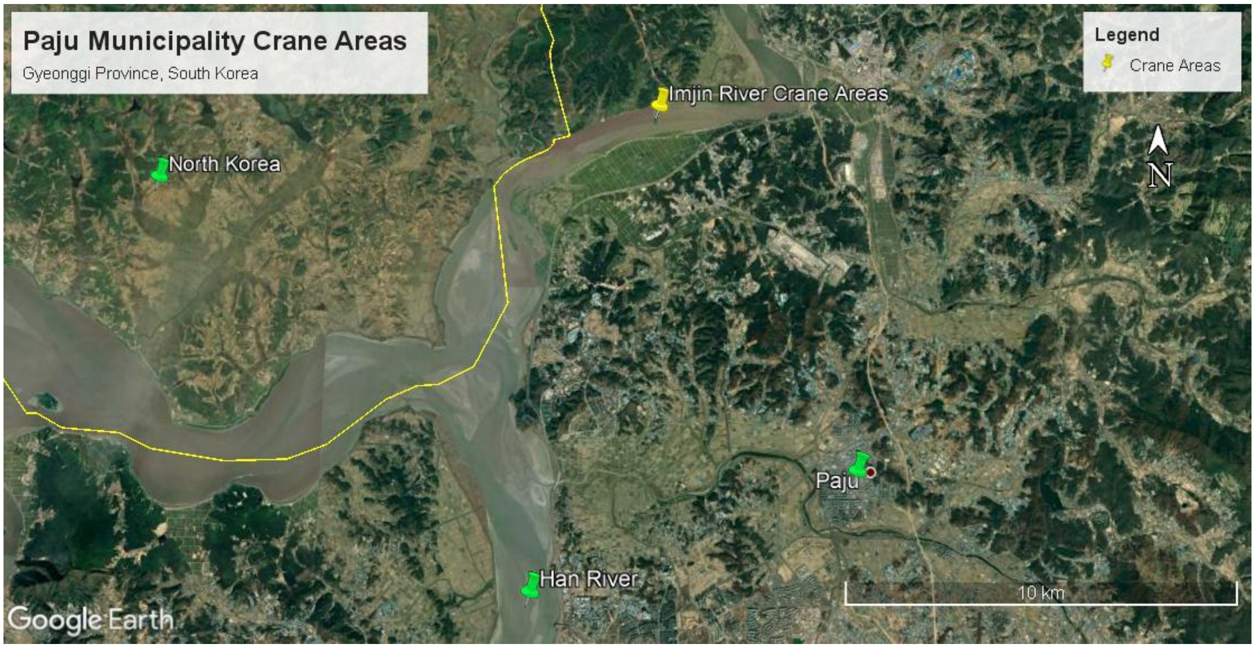

Figure 10.8. Overview of the Paju Municipality crane areas along the Imjin River, Gyeonggi Province, South Korea.

10.2.3. Panmunjeom Area, Kaesong, North Korea and Paju Municipality, South Korea

Panmunjeom (판문점, 37°56'40.65"N, 126°40'07.05"E) is a rice farming area in the Korean Peninsula's Demilitarized Zone (DMZ). The site is located about 5 km east of Kaesong in North Korea with the eastern portion lying in the northwest corner of Paju Municipality, South Korea (Fig. 10.9). The area is best known as the location where the Korean Armistice Agreement was signed on July 27, 1953, which ended the large-scale warfare of the Korean conflict if not the conflict itself. More recently, on June 30, 2019, U.S. president Donald Trump briefly stepped into North Korea at the Panmunjeom border crossing during the one-day DMZ summit with South Korean president Moon Jae-in and North Korean leader Kim Jong-un. The site consists of a small relatively undeveloped stream corridor flowing along the DMZ border fence that is lined on both the North and South Korean sides with rice paddies. This stream merges with the larger Kwangmyong River flowing out of Kaesong, which itself turns south to merge with the Imjin River near Paju.

Although DMZ tour buses travel to the Panmunjeom border crossing, at the time of my visit to South Korea in January 2020, all tours in the DMZ had been suspended due to an outbreak of African Swine Flu in the border region between North and South Korea. Regrettably, scientists have not been permitted to conduct bird surveys on the North Korean side of the border in a number of decades. However, in the 1970s, there were about 40 red-crowned and 60 white-naped cranes in the Panmunjeom area (George Archibald, personal communication, 18 December 2019; Prentice and Mirande, 2019). Nevertheless, Birdlife International has listed the Panmun Field as an Important Bird Area (IBA) in North Korea and also the neighboring Daeseongdong and Panmunjeom Marshes IBA in South Korea. Birds of significance for conservation at these two IBAs include red-crowned crane, white-naped crane, hooded crane, greater white-fronted

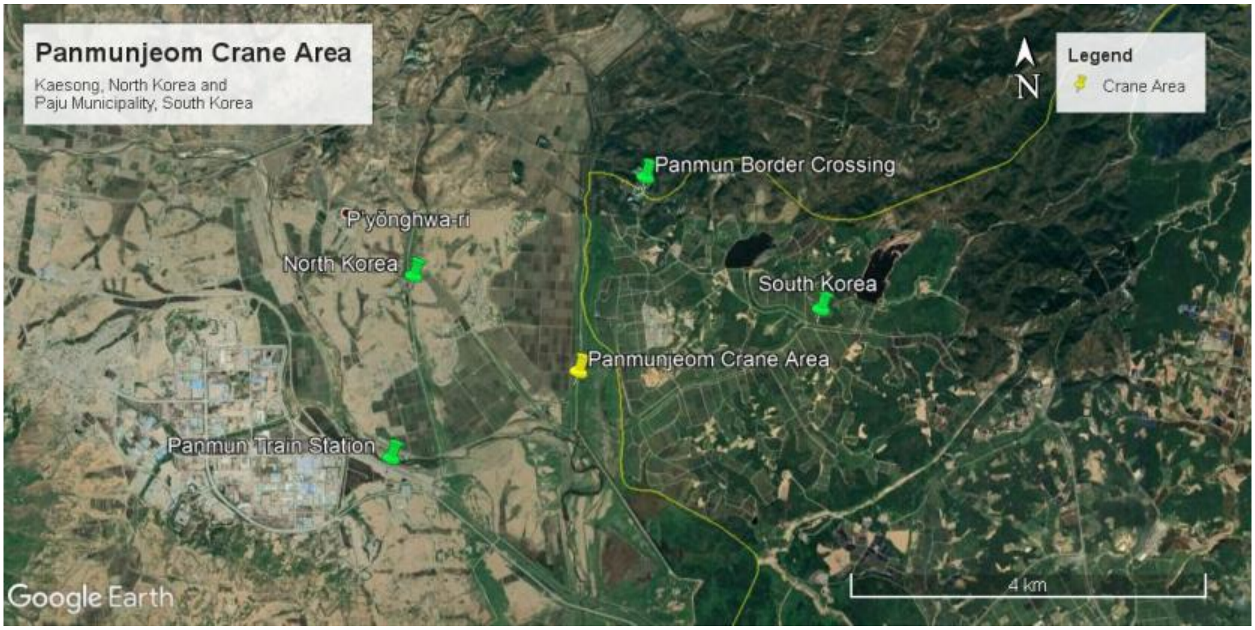

Figure 10.9. Overview of the Panmunjeom crane area in Kaesong North Korea and Paju Municipality, Gyeonggi Province, South Korea.

goose, swan goose, and oriental stork, which were all determined to be present in the Panmunjeom area in 2004 (BirdLife International, 2020a and 2020b).

10.2.4. Other Crane Wintering Sites in North Korea

The general consensus among South Korean crane experts is that there are no longer any other important crane wintering grounds in North Korea due to the decline in agriculture in the country since the 1990s, which has led to chronic food shortages there (Lee, 2009). The decline in North Korean agriculture may be contributing to increasing numbers of red-crowned and white-naped cranes in South Korea's Cheorwon and Yeoncheon Counties (see Sections 5 and 6)(Lee, 2009). In the past though, about 120 red-crowned cranes wintered in North Korea's Anbyon County. Other formerly significant crane wintering sites in North Korea were compiled by Lee (2009) and are summarized in Table 10.3.

Table 10.3. List of once significant crane wintering sites in North Korea.

County	Province	Latitude	Longitude
Mundok	South Pyongan	39°32'57.23"N	125°26'27.46"E
Kumya	South Hamgyong	39°32'53.23"N	127°14'34.53"E
Anbyon	Kangwon	39°02'36.26"N	127°31'29.89"E
Ryongyon	South Hwanghae	38°10'38.22"N	124°55'01.53"E
Taetan	South Hwanghae	38°05'07.20"N	125°18'02.67"E
Ongjin	South Hwanghae	37°56'03.56"N	125°21'47.99"E

Source: Lee, 2009.

11. Conclusion

Through the concerted efforts of dedicated conservationists, a number of crane populations in Northeast Asia have been brought back from the brink of extinction since the end of World War II (Table 11.1). These remarkable increases in crane numbers have been achieved largely through improved protection of cranes and their rapidly disappearing habitat, artificial feeding, and increased public awareness of threats to cranes. Nevertheless, threats to cranes persist. One of the largest threats is simply the high concentration of wintering cranes at just a few sites. This puts these large flocks at high risk of a mass die-off from an avian epidemic or an extreme weather event, such as an unseasonal typhoon. In the summer of 2020, following extreme flooding, water level at Poyang Lake reached a record high that threatened the winter food supply for Siberian Cranes (Xinhua, 2020). This resulted in roughly 2000 of these critically endangered cranes, half their global population, being concentrated in a single lotus root pond at the Nanchang Five Star Siberian Crane Sanctuary in November of 2020 (Millington, 2020). Although no epidemic occurred there, a year later in December 2021, 8000 common cranes died in a H5N1 avian influenza outbreak in Israel’s Hula Valley, illustrating how quickly deadly disease can spread among a highly concentrated crane population (Hartup, 2022).

Crane habitat also continues to be threatened, both directly by land reclamation and economic development activities, and indirectly by upstream degradation of watersheds and climate change impacts, such as rising sea levels. Many crane stopover and wintering areas still lack formal protection. Perhaps most notable is Cheorwon County, South Korea, where reunification of the Korean Peninsula may one day lead to development of the Demilitarized Zone and, paradoxically, the demise of Korea’s most important crane wintering grounds. And with increasing crane numbers has come increased conflict with farmers, including crop damage, damage to rice paddy water retention berms, and occasional injury to startled cows. Thus, despite remarkable crane population increases achieved through intensive conservation efforts, the long-term preservation of cranes in Northeast Asia remains a work in progress. Therefore, efforts to protect crane species will require the concerted action of conservationists, governments, and local residents for many decades to come.

Table 11.1. Summary of selected crane population increases at five winter sites in Northeast Asia, listed north to south.

Site	Crane Species	Year of Low Count	Low Count	Year of High Count	High Count
Hokkaido	Red-crowned	1952	33	2020	1800
Cheorwon	Red-crowned	1980s	250	2020	1232
Suncheon Bay	All Species (Mainly Hooded)	1996	70	2020	2521
Izumi	Hooded	1948	250	2019	13,501
Poyang Lake	Siberian Crane	1980	91	2018	3399

Source: Summarized from the respective report crane site sections, above.

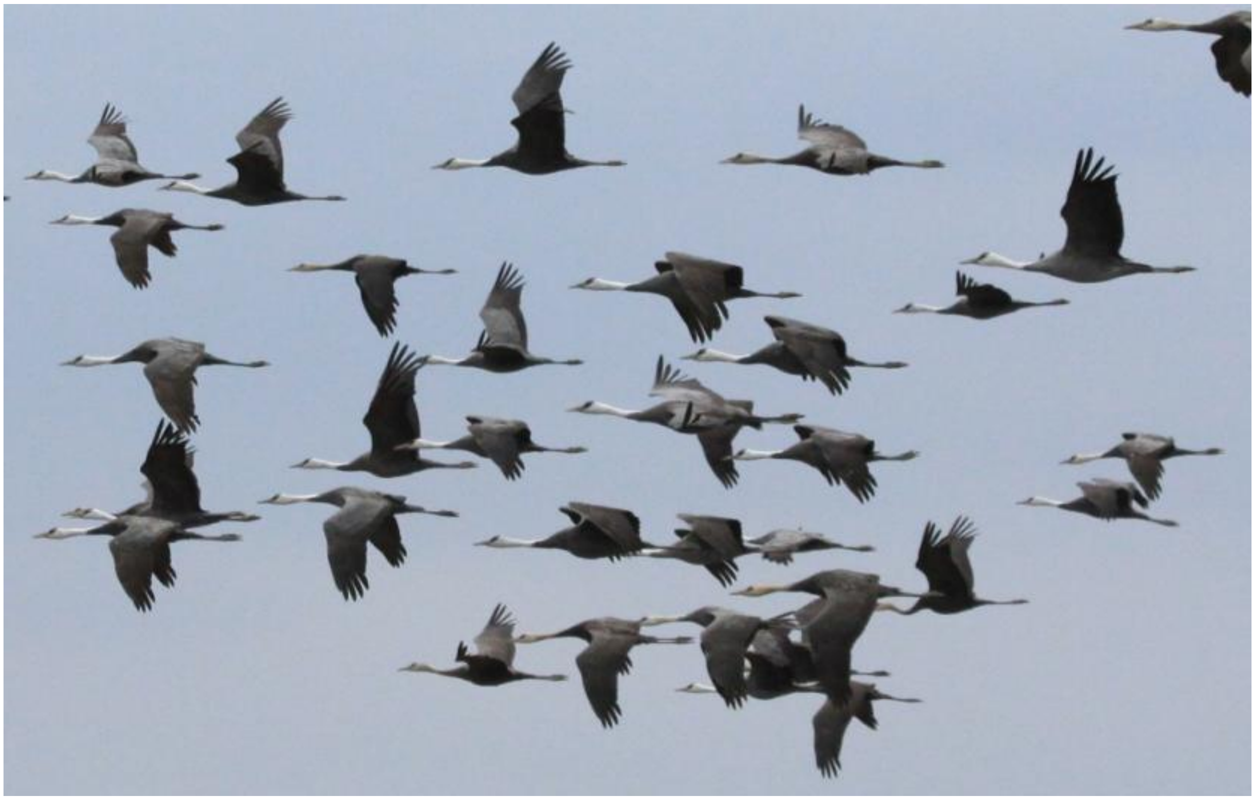

Figure 11.1. Hooded cranes sighted at the Izumi Crane Park along the Komenotsu River, Izumi, Kagoshima Prefecture, Japan.

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Appendix 1. Websites of Organizations involved in Crane and Bird Conservation in Northeast Asia

USA
International Crane Foundation (ICF), Baraboo, Wisconsin
https://www.savingcranes.org

Korea
Waterbird Network Korea, Seoul, South Korea
한국물새네트워크
http://wnkorea.org
https://m.cafe.daum.net/WNKorea

Suncheon Bay Wetland Reserve, Suncheon, South Korea
순천만습지
https://scbay.suncheon.go.kr/wetland/#firstSection

DMZ Peace Town for Migratory Cranes and DMZ Crane Committee, Cheorwon, South Korea
DMZ두루미평화타운
https://www.cwg.go.kr/site/dmzmpt/main.do

Clean Hantan River, Yeoncheon, South Korea
한탄강*지키기*운동본부
https://www.facebook.com/hantanr
http://hantanriver.net

Eco-Education Hub Waterfowl Egg, Ganghwa Do, South Korea
생태교육허브 물새알
http://moolseal.modoo.at

Ganghwa Bird Watching Club, Ganghwa Do, South Korea
강화탐조클럽
http://cafe.naver.com/ghbird

Seosan Birdland, Seosan, South Korea
서산버드랜드
http://birdland.seosan.go.kr

Yesan Oriental Stork Park, Yesan, South Korea
예산 황새 공원
http://www.yesan.go.kr/stork.do#popup

East Asian-Australasian Flyway Partnership (EAAFP), Incheon, South Korea
https://www.eaaflyway.net/

Japan

Izumi City Crane Museum and Park, Izumi, Kagoshima Prefecture, Japan
クレインパークいずみ
https://www.city.kagoshima-izumi.lg.jp/cranepark

Izumi Crane Observatory, Izumi, Kagoshima Prefecture, Japan
出水市ツル観察センタ
https://www.city.kagoshima-izumi.lg.jp/shisetsu/facilities/detail/140

Kagoshima Crane Conservancy, Izumi, Kagoshima Prefecture, Japan
鹿児島県ツル保護会
https://www.facebook.com/%E9%B9%BF%E5%85%90%E5%B3%B6%E7%9C%8C%E3%83%84%E3%83%AB%E4%BF%9D%E8%AD%B7%E4%BC%9A-249846792550036/

Red-crowned Crane Conservancy (RCC/TKG), Kushiro City, Hokkaido, Japan
タンチョウ保護研究グループ
http://www6.marimo.or.jp/tancho1213/RCC-English-home.html
http://www6.marimo.or.jp/tancho1213/RCC-Japanese-home.html

Akan International Crane Center, Kushiro Subprefecture, Hokkaido, Japan
阿寒国際ツルセンタ
https://aiccgrus.wixsite.com/aiccgrus

Japanese Association for Wild Geese Protection
雁を保護する会
http://www.jawgp.org

Appendix 2. List of Other Bird Species Sighted by Location

Table A2.1. Bird species sighted at Poyang Lake, Jiangxi Province, China, December 20-22, 2019.

Number	Common Name	Scientific Name
1	Common Pheasant	*Phasianus colchicus*
2	Tundra Swan	*Cygnus columbianus*
3	Swan Goose	*Anser cygnoides*
4	Bean Goose	*Anser fabalis*
5	Greater White-fronted Goose	*Anser albifrons*
6	Greylag Goose	*Anser anser*
7	Eurasian Wigeon	*Anas penelope*
8	Mallard	*Anas platyrhynchos*
9	Spot-billed Duck	*Anas poecilorhyncha*
10	Common Teal	*Anas crecca*
11	Common Kingfisher	*Alcedo atthis*
12	White-throated Kingfisher	*Halcyon smyrnensis*
13	Spotted Dove	*Streptopelia chinensis*
14	Siberian Crane	*Grus leucogeranus*
15	White-naped Crane	*Grus vipio*
16	Common Crane	*Grus grus*
17	Hooded Crane	*Grus monacha*
18	Common Moorhen	*Gallinula chloropus*
19	Common Coot	*Fulica atra*
20	Spotted Redshank	*Tringa erythropus*
21	Common Redshank	*Tringa totanus*
22	Pied Avocet	*Recurvirostra avosetta*
23	Northern Lapwing	*Vanellus vanellus*
24	Black-headed Gull	*Larus ridibundus*
25	Common Tern	*Sterna hirundo*
26	Whiskered Tern	*Chlidonias hybridus*
27	Hen Harrier	*Circus cyaneus*
28	Little Grebe	*Tachybaptus ruficollis*
29	Great-crested Grebe	*Podiceps cristatus*
30	Great Cormorant	*Phalacrocorax carbo*
31	Little Egret	*Egretta garzetta*
32	Grey Heron	*Ardea cinerea*
33	Eurasian Spoonbill	*Platalea leucorodia*
34	Oriental Stork	*Ciconia boyciana*
35	Long-tailed Shrike	*Lanius schach*
36	Common Green Magpie	*Cissa chinensis*
37	Daurian Redstart	*Phoenicurus auroreus*
38	Black-collared Starling	*Sturnus nigricollis*
39	Crested Myna	*Acridotheres cristatellus*
40	Light-vented Bulbul	*Pynconotus sinensis*
41	Dusky Warbler	*Phylloscopus fuscatus*
42	Oriental Skylark	*Alauda gulgula*
43	Eurasian Tree Sparrow	*Passer montanus*
44	White Wagtail	*Motacilla alba*
45	Water Pipit	*Anthus spinoletta*
46	Little Bunting	*Emberiza pusilla*

Table A2.2. Bird species sighted at Suncheon Bay, South Jeolla Province, South Korea, January 2-3, 2020.

Number	**Common Name**	**Scientific Name**
1	Whooper Swan	*Cygnus cygnus*
2	Bean Goose	*Anser fabalis*
3	Greater White-fronted Goose	*Anser albifrons*
4	Common Shelduck	*Tadorna tadorna*
5	Mallard	*Anas platyrhynchos*
6	Eastern Spot-billed Duck	*Anas poecilorhyncha*
7	Northern Pintail	*Anas acuta*
8	Baikal Teal	*Anas formosa*
9	Greater Scaup	*Aythya marila*
10	Common Merganser	*Mergus merganser*
11	Japanese Pygmy Woodpecker	*Dendrocopos kizuki*
12	Oriental Turtle Dove	*Streptopelia orientalis*
13	White-naped Crane	*Grus vipio*
14	Sandhill Crane	*Grus canadensis*
15	Common Crane	*Grus grus*
16	Hooded Crane	*Grus monacha*
17	Common Coot	*Fulica atra*
18	Eurasian Curlew	*Numenius arquata*
19	Northern Lapwing	*Vanellus vanellus*
20	Black-headed Gull	*Larus ridibundus*
21	Cinereous Vulture	*Aegypius monachus*
22	Hen Harrier	*Circus cyaneus*
23	Northern Goshawk	*Accipiter gentilis*
24	Common Kestrel	*Falco tinnunculus*
25	Grey Heron	*Ardea cinerea*
26	Eurasian Spoonbill	*Platalea leucorodia*
27	Black-billed Magpie	*Pica pica*
28	Daurian Redstart	*Phoenicurus auroreus*
29	Marsh Tit	*Parus palustris*
30	Brown-eared Bulbul	*Ixos amaurotis*
31	Japanese White-eye	*Zosterops japonicus*
32	Vinous-throated Parrotbill	*Paradoxornis webbianus*
33	Eurasian Tree Sparrow	*Passer montanus*
34	White Wagtail	*Motacilla alba*
35	Grey-capped Greenfinch	*Carduelis sinica*
36	Yellow-billed Grosbeak	*Eophona migratoria*
37	Rustic Bunting	*Emberiza rustica*
38	Yellow-throated Bunting	*Emberiza elegans*

Table A2.3. Bird species sighted at the Ganghwado Mudflats, Incheon Municipality, South Korea, January 4, 2020.

Number	**Common Name**	**Scientific Name**
1	Common Shelduck	*Tadorna tadorna*
2	Mallard	*Anas platyrhynchos*
3	Spot-billed Duck	*Anas poecilorhyncha*
4	Red-crowned Crane	*Grus japonensis*
5	Vega (Mongolian) Gull	*Larus vegae*
6	Large-billed Crow	*Corvus macrorhynchos*
7	Daurian Redstart	*Phoenicurus auroreus*
8	Great Tit	*Parus major*
9	Eurasian Tree Sparrow	*Passer montanus*

Table A2.4. Bird species sighted at Yeoncheon County, Gyeonggi Province, South Korea, January 7, 2020.

Number	**Common Name**	**Scientific Name**
1	White-naped Crane	*Grus vipio*
2	Red-crowned Crane	*Grus japonensis*
3	White-tailed Eagle	*Haliaeetus albicilla*
4	Black-billed Magpie	*Pica pica*
5	Eurasian Tree Sparrow	*Passer montanus*
6	Hawfinch	*Coccothraustes coccothraustes*

Table A2.5. Bird species sighted at Cheorwon County, Gangwon Province, South Korea, January 6-8 and 12, 2020.

Number	Common Name	Scientific Name
1	Whooper Swan	*Cygnus cygnus*
2	Greater White-fronted Goose	*Anser albifrons*
3	Snow Goose	*Anser caerulescens*
4	Eurasian Wigeon	*Anas penelope*
5	Mallard	*Anas platyrhynchos*
6	Spot-billed Duck	*Anas poecilorhyncha*
7	Northern Pintail	*Anas acuta*
8	Baikal Teal	*Anas formosa*
9	Common Teal	*Anas crecca*
10	Japanese Pygmy Woodpecker	*Dendrocopos kizuki*
11	Eurasian Eagle Owl	*Bubo bubo*
12	Oriental Turtle Dove	*Streptopelia orientalis*
13	White-naped Crane	*Grus vipio*
14	Sandhill Crane	*Grus canadensis*
15	Common Crane	*Grus grus*
16	Hooded Crane	*Grus monacha*
17	Red-crowned Crane	*Grus japonensis*
18	White-tailed Eagle	*Haliaeetus albicilla*
19	Cinereous Vulture	*Aegypius monachus*
20	Hen Harrier	*Circus cyaneus*
21	Common Buzzard	*Buteo buteo*
22	Common Kestrel	*Falco tinnunculus*
23	Great Egret	*Casmerodius albus*
24	Bull-headed Shrike	*Lanius bucephalus*
25	Chinese Grey Shrike	*Lanius sphenocerus*
26	Azure-winged Magpie	*Cyanopica cyanus*
27	Black-billed Magpie	*Pica pica*
28	Large-billed Crow	*Corvus macrorhynchos*
29	Dusky Thrush	*Turdus eunomus*
30	Daurian Redstart	*Phoenicurus auroreus*
31	Vinous-throated Parrotbill	*Paradoxornis webbianus*
32	Eurasian Tree Sparrow	*Passer montanus*
33	Brambling	*Fringilla montifringilla*
34	Grey-capped Greenfinch	*Carduelis sinica*
35	Long-tailed Rosefinch	*Uragus sibiricus*
36	Hawfinch	*Coccothraustes coccothraustes*
37	Meadow Bunting	*Emberiza cioides*
38	Rustic Bunting	*Emberiza rustica*
39	Yellow-throated Bunting	*Emberiza elegans*
40	Pallas's Bunting	*Emberiza pallasi*
41	Reed Bunting	*Emberiza schoeniclus*

Table A2.6. Bird species sighted at the Izumi Crane Museum, Crane Park, and Komenotsu River, Izumi, Kagoshima Prefecture, Japan, January 15, 2020.

Number	Common Name	Scientific Name
1	Gadwall	*Anas strepera*
2	Falcated Duck	*Anas falcata*
3	Eurasian Wigeon	*Anas penelope*
4	Mallard	*Anas platyrhynchos*
5	Spot-billed Duck	*Anas poecilorhyncha*
6	Common Teal	*Anas crecca*
7	Rock Pigeon	*Columba livia*
8	White-naped Crane	*Grus vipio*
9	Hooded Crane	*Grus monacha*
10	Common Coot	*Fulica atra*
11	Common Sandpiper	*Actitis hypoleucos*
12	Osprey	*Pandion haliatus*
13	Little Grebe	*Tachybaptus ruficollis*
14	Great Cormorant	*Phalacrocorax carbo*
15	Little Egret	*Egretta garzetta*
16	Great Egret	*Casmerodius albus*
17	Grey Heron	*Ardea cinerea*
18	Black-crowned Night Heron	*Nycticorax nycticorax*
19	Bull-headed Shrike	*Lanius bucephalus*
20	Large-billed Crow	*Corvus macrorhynchos*
21	Pale Thrush	*Turdus Pallidus*
22	Dusky Thrush	*Turdus eunomus*
23	White-cheeked Starling	*Sturnus cineraceus*
24	Brown-eared Bulbul	*Ixos amaurotis*
25	Eurasian Tree Sparrow	*Passer montanus*
26	White Wagtail	*Motacilla alba*
27	Japanese Wagtail	*Motacilla grandis*
28	Grey Wagtail	*Motacilla cinerea*
29	Grey-capped Greenfinch	*Carduelis sinica*
30	Chestnut-eared Bunting	*Embiriza fucata*

Table A2.7. Bird species sighted at the Izumi Crane Observation Center, Izumi, Kagoshima Prefecture, Japan, January 16 and 18, 2020.

Number	Common Name	Scientific Name
1	Common Shelduck	*Tadorna tadorna*
2	Eurasian Wigeon	*Anas penelope*
3	Mallard	*Anas platyrhynchos*
4	Spot-billed Duck	*Anas poecilorhyncha*
5	Northern Pintail	*Anas acuta*
6	Common Teal	*Anas crecca*
7	Greater Scaup	*Aythya marila*
8	Common Kingfisher	*Alcedo atthis*
9	Rock Pigeon	*Columba livia*
10	Oriental Turtle Dove	*Streptopelia orientalis*
11	White-naped Crane	*Grus vipio*
12	Sandhill Crane	*Grus canadensis*
13	Demoiselle Crane	*Grus virgo*
14	Common Crane	*Grus grus*
15	Hooded Crane	*Grus monacha*
16	Common Coot	*Fulica atra*
17	Common Snipe	*Gallinago gallinago*
18	Green Sandpiper	*Tringa ochropus*
19	Common Sandpiper	*Actitis hypoleucos*
20	Northern Lapwing	*Vanellus vanellus*
21	Black Kite	*Milvus migrans*
22	Peregrine Falcon	*Falco peregrinus*
23	Little Grebe	*Tachybaptus ruficollis*
24	Great Cormorant	*Phalacrocorax carbo*
25	Little Egret	*Egretta garzetta*
26	Grey Heron	*Ardea cinerea*
27	Great Egret	*Casmerodius albus*
28	Eurasian Spoonbill	*Platalea leucorodia*
29	Black-faced Spoonbill	*Platalea minor*
30	Bull-headed Shrike	*Lanius bucephalus*
31	Rook	*Corvus frugilegus*
32	Large-billed Crow	*Corvus macrorhynchos*
33	Dusky Thrush	*Turdus eunomus*
34	Daurian Redstart	*Phoenicurus auroreus*
35	Brown-eared Bulbul	*Ixos amaurotis*
36	Japanese White-eye	*Zosterops japonicus*
37	Eurasian Skylark	*Alauda arvensis*
38	Eurasian Tree Sparrow	*Passer montanus*
39	White Wagtail	*Motacilla alba*
40	Grey Wagtail	*Motacilla cinerea*
41	Buff-bellied Pipit	*Anthus rubescens*
42	Grey-capped Greenfinch	*Carduelis sinica*
43	Japanese Grosbeak	*Eophona personata*
44	Black-faced Bunting	*Emberiza spodocephala*
45	Reed Bunting	*Emberiza schoeniclus*

Table A2.8. Bird species sighted at the Akan International Crane Center and surrounding dairy farms, Kushiro Subprefecture, Hokkaido, Japan, January 25-26, 2020.

Number	**Number**	**Number**
1	Whooper Swan	*Cygnus cygnus*
2	Mallard	*Anas platyrhynchos*
3	Rock Pigeon	*Columba livia*
4	Red-crowned Crane	*Grus japonensis*
5	Black Kite	*Milvus migrans*
6	White-tailed Eagle	*Haliaeetus albicilla*
7	Steller's Sea Eagle	*Haliaeetus pelagicus*
8	Carrion Crow	*Corvus corone*
9	Large-billed Crow	*Corvus macrorhynchos*
10	Great Tit	*Parus major*
11	Eurasian Tree Sparrow	*Passer montanus*

Table A2.9. Bird species sighted in Tokachi Subprefecture, Hokkaido, Japan, January 27-28, 2020.

Number	**Number**	**Number**
1	Whooper Swan	*Cygnus cygnus*
2	Mallard	*Anas platyrhynchos*
3	Spot-billed Duck	*Anas poecilorhyncha*
4	Common Teal	*Anas crecca*
5	Common Merganser	*Mergus merganser*
6	Great Spotted Woodpecker	*Dendrocopus major*
7	Ural Owl	*Strix uralensis*
8	Rock Pigeon	*Columba livia*
9	Red-crowned Crane	*Grus japonensis*
10	White-tailed Eagle	*Haliaeetus albicilla*
11	Great Egret	*Casmerodius albus*
12	Dusky Thrush	*Turdus eunomus*
13	Carrion Crow	*Corvus corone*
14	Long-tailed Tit	*Aegithalos caudatus*
15	Eurasian Tree Sparrow	*Passer montanus*

Appendix 3. Travel Notes

Some brief information on overland and ferry travel between crane sites at the time of this field trip is provided below. In some instances, the cost of air travel between major cities can actually be the same or cheaper.

Table A3.1. Travel information between major crane sites in Northeast Asia, Winter 2019-2020.

Date	Description	Cost*	Notes
December 2019	Train: Shenzhen to Nanchang	USD 83.24	~4.5 Hours
December 2019	Train: Nanchang to Qingdao	CNY 692	~11 Hours
December 2019	Ferry: Qingdao to Incheon	CNY 405	~ 20 Hours on board
December 2019	Metro: Incheon to Seoul	KRW 2200	
January 2020	Train: Seoul to Suncheon	USD 41.69	2 hours, 40 Minutes
January 2020	Bus: Seoul to Ganghwado	KRW 6000	
January 2020	Bus: Seoul to Cheorwon	KRW 10,000	
January 2020	Train: Seoul to Busan	USD 43.62	3 Hours, 10 Minutes
January 2020	Ferry: Busan to Fukuoka	JPY 4500	~12 Hours on Board
January 2020	Train: Fukuoka to Izumi	JPY 7940	
January 2020	Bus Izumi to Kagoshima Airport	JPY 1400	
January 2020	Bus Kagoshima Airport to Kagoshima Station	JPY 1000	
January 2020	Train: 14-Day Japan Rail Pass (purchased in Kagoshima)	JPY 52,960	Japan Rail Passes can also be purchased in Fukuoka
January 2020	Ferry Aomori to Hakodate	JPY 2260	~ 4 Hours on Board

*Winter 2020 Exchange Rates:
1.00 USD = 7.00 CNY
1.00 USD = 1160 KRW
1.00 USD = 110 JPY